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THE NAUTILUS

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ON THE SONORAN SIDE OF THE GULF

BY H. N. LOWE

Since my visit to San Felipe on the Gulf coast of Lower California in May of last year, I have had a great desire to explore the Sonora coast on the opposite side of the Gulf.

After some discussion with Mr. Clinton Abbott, Director of the San Diego Museum of Natural History, we decided on an expedition to Punta Peñasco, a point between Adair Bay and Bahia San Jorge. Mr. L. M. Huey (curator of birds and mammals) was chosen to head the expedition, with two assistants, Lorenzo Cook and Phil. Lichty.

On February 6 we left San Diego with provisions for three weeks, forty-five gallons drinking water, extra gasoline, and complete camp outfit, in the Museum's Ford truck. The main paved highway we left at Gila Bend and started due south over a well graded desert road for eighty miles to the international boundary, passing midway the important copper mining town of Ajo, where the mines have been shut down for several years.

The desert vegetation was mostly a well spaced, even growth of creosote bush with an occasional mesquite, and comparatively little cactus. About twenty miles from the border we passed quite close to the Ajo Mountains which are composed mostly of black lava. It is one of the most spectacular ranges I have ever seen; with its fantastic crags and spires reminding one of some painted scene in a theater. Perhaps they seemed more fantastic in this colorful hour before sunset, when all the wonderful shades of blue, lavender and purple appear, as all desert travelers know.

Just below the border, the sleepy little town of Sonoyta lies in a green oasis formed by the Sonoyta River. It is practically

self-supporting save for a few imported American clothes and sundries. They live under their own vines and fig trees and grind their corn for tortillas as in ages past. They use the primitive "arastras," driven by a blindfolded donkey, to crush a little gold ore brought from the neighboring mountains. About twelve miles to the southeast is the San Francisco range of granitic mountains, and as our trail ran quite close to the southern end, we stopped for a short exploration. On one of the north slope I uncovered a small colony of desert micrariontas as yet unidentified.

Along this part of the road was quite a vigorous growth of mesquite, ironwood, palo verde, and numerous "saguaros" or giant cacti, rarely branched.

As the road ran southwestward toward the Gulf, the vegetation grew sparser until nothing but creosote bush remained. The black lava Pinacate Range lay off to the right, where a few mountain sheep still live.

It was long after dark when we reached the fifteen miles of sand hills bordering the coast. We were overloaded by about a thousand pounds with extra gas, water and provisions, besides our camp and collecting equipment. The road had not been "brushed" lately and the ruts were worn deep in the soft sand. We were stalled several times, when we had to pull up all the brush in the vicinity to put under the wheels and then all go at it and push. After being stalled many times we at last reached our destination about midnight, when we slept fitfully under the stars till morning,—dreaming we were still stalled in the sand.

We found a level spot about a hundred yards from the beach where we pitched our tents and made camp as shipshape as possible.

The collection of habitations of the fisherfolk was wonderful to behold, some made of heaped up lava blocks for sides with canvas on tin can roofs, others entirely of tin cans and in one hillside was a row of dugouts which we called the "Troglodyte village." One "cave man" and his wife were running a *panderia* (bakery) where good "pan blanco" and "pan dulce"

could be purchased at a peso per dozen. Another family from Guaymas, here for the season, kept a small *tienda* (store) where a few necessities could be purchased, such as panoche, red beans, a few canned goods, gas, water and a little wood; all hauled sixty-two miles over these terrible roads from Sonoyta.

During the fishing season for the black sea bass or "tortuava," as they are called, there are a dozen or so small fishing boats at anchor in the shelter of the tiny natural breakwater of lava boulders which runs out some five hundred yards from shore. As the tides in this part of the Gulf have a rise and fall of eighteen feet and more, the boats were all lying on their sides on the beach at low water.

On our arrival a series of heavy tides was just commencing. As the tides are about two hours later than on the Pacific coast, the best tides came after dark, but the secondary morning tides proved very acceptable. From our camp at Punta Peñasco a beautiful sand beach curved for seven miles to "Punta La Cholla" on the north, which marked the beginning of Adair Bay. On the other side stretched more miles of sand beach toward Bahia San Jorge.

The upper parts of the sand beaches were composed of unnumbered tons of broken and finely ground shells, which would not pack and made walking difficult. At an extreme low tide the transformation was almost unbelievable. After a fall of about ten feet the sand beach gave place to a series of fossiliferous sandstone ledges with small sand patches intervening, paralleling the shore. When the tide runs far from shore there are three or four of these ledges visible. On the shoreward side of these ledges, the soft sandstone was being continually undercut, leaving large strips a few inches thick with an overhang of two or three feet. While the upper side had a good growth of algae, the under surface was brightly decorated with bunches of ascidians in blue, orange and yellow, where many echinoids and crustaceans had their homes. Large slabs of this undercut sandstone were constantly breaking from the main ledges, giving wonderful hiding places for rarer mollusks such as *Cypraea, Trivia, Lima, Anachis,* and *Pleurotoma.* In the edges of freshly

broken slabs could be seen holes bored into the fossils of thousands of years ago by a recent burrowing mollusk called *Lithophagus aristatus,* a few *L. attenuata* and *Petricola* were with them. In the sand between ledges, near town, were many *Olivella dama,* which the native women were gathering to make necklaces. On the reefs many *Murex nigritus* were feeding on an inexhaustible supply of *Cerithium stercus-muscarum* and plowing through the sand searching for bivalves were the beautiful pink mouthed *Murex bicolor.* Further along the sand beach were found some fine live *Agaronia testacea,* which leave a heavy dent in the sand at low tide. Near La Cholla I struck a small bar of coarse shell sand not over an acre in extent, where some fine large *Conus interruptus* and the huge *Oliva incrassata* were burrowing; also quite a colony of *Glycimeris maculata,* the first I had ever taken in quantity. We secured sufficient for a very delicious soup, probably the first such soup on record. The upper surface of some of the rocks was covered with a brownish green algae which afforded feeding grounds for *Trivia solandri* and a small black *Crassispira pluto* Pilsbry & Lowe.

The numerous large kitchen-middens both at Punta Peñasco and Punta La Cholla contained thousands of these *Glycimeris maculata* with rarely a valve of the much larger *G. gigantea.* With these were quantities of the huge *Cardita affinis, Chione, Ostrea, Paphia, Cardium* and large *Murex.* No stone artifacts or black earth were noted in any of these shell heaps. Perhaps the early inhabitants preferred their shell-fish raw.

The sea gulls enjoyed gathering live *Cardium procerum,* flying aloft, dropping them on the rocks, where one valve would be broken, affording an easy morsel.

There were many old valves of *Dosinia ponderosa* lying inside down,—thus furnished good hiding places for the small black *Seila attenuata.*

For two weeks the days were clear and warm and the nights not too cold; no wind ruffled the dark blue mirror surface of the Gulf. Every night a gorgeous sunset with varying cloud and color effects over the San Pedro Martyr Mountains across the Gulf in Lower California.

(To be continued)

A CONCHOLOGICAL RIP VAN WINKLE

BY FRED BAKER

During my six months in Brazil as surgeon and conchologist of the Stanford Expedition in 1911 I paid a small sum to two laborers for bringing in to me 2000 specimens of a tree snail which I later reported (Proc. Acad. Nat. Sci. Phil., 1913, p. 639.) as *Oxystyla pulchella prototypus* Pilsbry. The specimens were in all stages of growth with about one in ten full grown. It was curious that almost all the full grown specimens were aestivating on the tree trunks and lower branches while the younger specimens were nearly all crowded into crevices and knot holes in the trees. This impressed me so strongly that I was almost sure that the specimens represented two distinct species. Only a very careful study of all stages represented by the catch showed their continuity of growth. All were taken on the outskirts of Ceará-Mirim, State of Rio Grande do Norte, Brazil, just a few degrees south of the Equator. The State of Rio Grande do Norte on the east coast of Brazil is an extremely dry country with an average rainfall not far from that of Southern California, although much warmer. So, when packing to return, I determined to try to bring a few specimens home alive. I packed a five gallon oil can full of them loosely in cotton. On arrival in California I found the shells dead, due most largely, as it seemed, to the cold of October in New York. Having a large supply, I have distributed these shells very widely to exchangers from Australia and New Zealand to Brazil, many parts of Europe, Mexico and the United States.

On March 23 I discovered a half-grown specimen, alive and apparently in fine health, calmly disporting himself on my back porch. We transferred him to comfortable quarters with abundance of food and water and he is active and seems inclined to live on, though we are not sure that he has yet eaten the kinds of food we have offered him. We have got a good photograph of him.

It seems almost absolutely certain that this snail is one of the original lot. The only other explanation would be that some of

these shells, surviving the trip to California in 1911, may have gotten out of the oil can before and may have established a colony. No such colony has been observed and I have been living on this lot since 1898, gardening and maintaining a gardener all the time. I am sure that such a colony would have been observed before. Should one appear I will immediately notify THE NAUTILUS and recede from my position; but I have no hesitation in stating at this time that this particular snail (which the children immediately christened Rip Van Winkle), is one of the original lot which has recently broken through his epiphragm and started out to see the world. The shells were collected in June or July, 1911, so it seems almost beyond question that Rip, Jr., is now, March 27, 1934, over twenty-three years old.

Tryon (Struct. and Syst. Conchology, vol. 1, pp. 144–148), discusses the "Duration and Tenacity of Life" in mollusks. He mentions a specimen of *Helix veatchii* which lived six years without food and a "Desert-snail from Egypt" which evidently had closed itself in its shell with an epiphragm in the British Museum, but had emerged at various times during a period of four years. I think I can safely claim an all-time record for my specimen.

Incidentally, Dr. Pilsbry, (*loc. cit.*, 1930, pp. 359, 360), on more careful examination of the set of *Oxystyla* which I left in Philadelphia, decided that they represented a new species which he has described as *Oxystyla capax*. Will any of my exchangers who happen to see this note please rename their sets as above? They will be safe to note that they are topotypes from the original lot.

Point Loma, California, March 27, 1934.

JAMAICAN LAND SNAILS

BY H. BURRINGTON BAKER

Unfortunately, the earlier writers seldom gave accurate localities in their descriptions of Jamaican mollusks. For this reason, locality records of the species, incidentally collected during the summer of 1933 in a search for anatomical material, may be of

interest. Through the kindness of Dr. Pilsbry, I have been able to compare many of the species with C. B. Adams' original material, which now belongs to Amherst College.

Unless otherwise indicated, these records are based on animals collected alive; even fresh, dead shells of medium-sized and large species are untrustworthy evidence, because they are often transported several miles by hermit-crabs, which spread inland from the ocean and periodically return. My visit followed a severe drouth of eight months' duration, which made the collection of living, adult land-shells quite difficult, and included several torrential rains, which almost prevented the securing of fresh-water forms.

Because the names of present and former estates were often duplicated, even in the same parish, coordinates of my stations have been taken from the 1905 edition of the 1888 Public Works Department Map of Jamaica on a scale of 2.698 miles to the inch. These are given, in parentheses after each locality, as two sets of three figures, of which the first digit stands for the degree of longitude (*e.g.*, 7 means 77°) and the two following for the minutes; those in the second set indicate the latitude by the same method. These coordinates are followed by the estimated altitudes in hundreds of feet and my field station number.

Eastern Area [E], collected from Port Antonio and Manchioneal, August 19 to 31; [EBL] eastern Blue Mts., heavy rain-forest on older rocks (my only station off the limestone) between Millbank and Cuna Cuna Pass, St. Thomas (623, 800–2; 20–27; 37); [EEC] extreme east coast, brush and wooded ledges along left bank near mouth of Hector River, St. Thomas (615, 800; 0–1; 40); [EEJ] eastern end of John Crow Mts. near Portland-St. Thomas boundary, including (a) north-facing slopes and huge blocks on a summit near Greenfield (618, 800; 16–18; 39a) and (b) canyon-ravine to crest where big fan-palms and tree-ferns prevail (619, 800; 16–21); [EJ] John Crow Mts., Portland; [EJ1] canyon and falls of Jungle Creek, west of Ecclestown (620, 803; 10–18; 38); [EJ2] woods halfway between Sherwood Forest and Egg Hill (622, 808; 15–18; 33); [EJ3] near Nonesuch (625, 810; 13–18; 35); [EJF] coastal foot-hills behind reservoir for Port Antonio (626, 811; 6–10; 34); [EJG] west-facing slops, partially cultivated, near Good

Hope (627, 809; 5–8; 32); [ENF] ravine in coconut plantation and wooded coastal hills on Spring Garden, St. Margaret's Bay (632, 812; 3–5; 36)

Kingston, St. Andrews [K], August 5 to 15; [KC1] Long Mt. east of Mona and down Hope River gorge (643–46, 757–801; 0–5; 28); [KC2] from near springs to top of Long Mt., east of Rockfort Gardens (645, 758; 0–8; 27); [KCC] coastal St. Catherine, from north end of Port Henderson Hill, down west side to near Campeachy Gully (654, 756–7; 0–6; 31); [KF] 1.5 miles out of Constant Spring on east side of road to Stony Hill, along gutter of waterworks (647, 804; 4–5; 30); [KHS] Stony Hill, both west and east of P. O. (648, 805; 12–16; 26); [KHW] Bog Walk, St. Catherine (701, 806; 3–17; 29), including (a) left bank 1 mile below station, south-facing slopes to summit, and (b) right bank, ravine just above entrance to first railroad tunnel downstream from town.

Mandeville, Manchester [M], June 14 to July 5 and September 2 to 8; [ML1] precipitous, east-facing slopes above Peace River, Clarendon (726, 806; 20–25; 41); [ML2] summits above Porus and dry sink at Belretiro (728, 801; 17–18; 4); [MM1] around Williamsfield railroad station, cursory collecting (729, 804; 13; 8); [MM2] ½ to 1½ miles south of Wesleymount Church (729, 803; 16–20; 2); [MM3] near Newleigh Hotel, just east of Mandeville (732, 802; 21–23; 1), including (a) the gardens, (b) woods south of Williamsfield-Mandeville road and (c) woods north of hotel; [MM4] sink-holes and sharp hills, ½ mile from Spurtree P. O. on direct road to Mandeville (735, 800; 22–25; 3); [MN] Somerset region; [MN1] 2 and 3½ miles from Mandeville on road to Mile Gully (732, 803–4; 17–20; 6); [MN2] dryish hills and sink-hole, west of Marshall Pen and east of Mandeville-Somerset road (734, 804; 22–26; 7); [MN3] Somerset (735, 805; 21–25; 5), including (a) hills and sink-hole northeast of parochial road near south boundary, (b) higher hills and sink-holes west of road and (c) cliff-bases east of road and ½ mile north of house.

Balaclava, St. Elizabeth [NM], July 27 to August 2: [NM1] ¼ mile southeast of station on Chewmagna (740, 810; 8–10; 21); [NM2] hills north of Rotten Gut, Manchester, including (a) Comfort Hill (737, 811; 5–15; 22a), (b) between Green Hill and Waterloo (737, 811–12; 7–20) and (c) cliffs along left bank of One Eye River on Oxford (738, 812; 5); [NMM] second growth on ridges south of Medina, Manchester (738, 807; 10–14; 24); [NMT] disturbed hills and cockpits between Troy and Coco River, Trelawney (738, 807; 20–25; 23); [NMV] Cockpit Country near Bullett Hall, St. Elizabeth (743, 814; 15–18; 25).

Montego Bay, St. James (V, including west edge of Cockpit Country), July 6 to 18: [VCM] east of town in (a) logwood plantations (757, 829; 4; 9a), (b) the gully, (c) hills near Rosemount (alt. 5–6) and (d) near Paradise (756, 830; 2–4); [VCN] north coast near Iron Shore (754, 832; 0–2; 14); [VF] ravine about one mile southeast of sharp curve in railroad south of Retirement River (756, 826; 2–4; 10); [VW1] east of Montpelier station to head of Anchovy Gully (756, 823; 4–12; 12); [VW2] hills 2 to 4 miles northeast of Catadupa station (753, 818; 16–21; 11); [VWS] dryish cockpit, ¼ mile west of Ipswich station, St. Elizabeth (751, 812; 7–8; 13).

Sav-la-Mar, Westmoreland [W], July 19 to 25: [WV] from lower source of Roaring River west to top of ridge and beyond (805, 818; 1–18; 17); [WSF] from Waterwheel up coastal ridge almost to summit (803, 812; 0–15; 18); [WC1] upper part of creek and base of ridges on Sweet Water (806, 814; 0–1; 20); [WC2] logwood plantations around Kingswood (809, 813; 0; 15); [WWF] foothills north of Retreat and valley beyond for about 2 miles west (817, 816; 1–6; 19); [WWC] dry woods in Negril Hills, southwest of Retreat almost to Crosbie (818, 813; 2–5; 16).

The following habitat terms are employed: deep-in-rocks (1 to 4 feet below surface); rock-bases (seldom seen climbing); ground (in and on dead leaves, etc.); weak climber (attaining about 3 ft. above ground during rains); fair climber (up to 10 ft.), good climber (higher yet); rock-faces (remaining there on clear days); subarboreal (in trees most of the time); arboreal (almost never seen on ground), including leaf-arboreal (minute species aestivating on under-sides) and trunk-arboreal (ditto on bark). The habitat notes are based on adults; juveniles usually show one degree more climbing propensity.

Lucidella (*Poenia*) *adamsiana sublaevis,* new subsp.

Similar to *adamsiana* but often slightly higher, without hairs at any stage of growth (in *adamsiana,* these are only absent ¼ whorl beyond embryonic shell); typically greenish white (colored animal) but also with orange brown form (like *adamsiana*); spirals lower on all whorls and becoming obsolete or obsolescent on last whorl, where fine growth threads are much more regular and more rounded. As in *adamsiana,* embryonic whorls 1¼ (sutural = about ¾ growth), relatively smooth, but with fine, weakly beaded growth wrinkles and blurred major spirals, which

increase in strength; horny plate of operculum radially striate. Alt. (of type male) 4.9 mm., maj. diam. 143 (7.0 mm.), alt. apert. 52 (2.5 mm.), diam. apert. 132 (3.3 mm.), with $4\frac{1}{8}$ post-embryonic whorls.

No actual intergradation in pubescence has been found, but the hairs of *adamsiana* are deciduous and even living specimens may have lost the hair-scars over part of their surface; also one albino paratype of *sublaevis* has its weak basal spirals irregularly strengthened into brownish spots. Type locality (Acad. Nat. Sci. Philadelphia no. 162731): MM3b.

Stoastomops adamsi, new sp. [*Helicina tenuis* C.B.A. (Sept., 1849, Cont. Conch. 1: 14), *Trochatella tenuis* (*op. cit.*: 16) not *H. tenuis* Pfr. (April, 1849)].

Like *S. walkeri* H.B.B., from Bonaire, D. W. I., but imperforate, although often with deep groove behind columella, with penultimate whorl obtusely angulate above distinct suture and last whorl more convex although scarcely angulate; spiral ridgelets more widely spaced above and becoming weaker on last whorl (6–7 above, 28–29 below periphery); operculum almost plane except for decided thickening of lower $\frac{3}{4}$ of parietal edge; radula with cusps of A-lateral larger than those of B, with 21 marginals, of which 5 are unicuspid, 1 bicuspid and 4 tricuspid. Alt. (of type female) 2.22 mm., maj. diam. 114 (2.52 mm.), alt. apert. 44 (.97 mm.), diam. apert. 133 (1.29 mm.); opercular width (from another female) .82 mm., length 139 (1.13 mm.).

Type locality (ANSP. 162861): on outer surfaces of quite exposed rocks, sometimes one per square cm., halfway up Long Mountain (KC2). Because Adams preferred *T. tenuis* on a later page of the same paper, I believe his name is valid but Dr. Pilsbry disagrees.

Eutrochatella pulchella cavearum, new subspecies.

As small or smaller than *scitula* (Wood), with peripheral carina quite sharp and continuous (instead of undulate or broken), with 5 spirals above and 15 visible below, without reddish markings (or with light, orange-tinted band below peripheral carina). Alt. (of type male) 7.5 mm., maj. diam. 110 (8.2 mm.), min. diam. 90 (6.7 mm.), with $1\frac{1}{4}$ (sutural) embryonic and $5\frac{1}{4}$ post-embryonic whorls. Type locality (ANSP. 162732): NM2c.

E. pulchella cathartensis, new subspecies.

Nearest *multicarinata* (C.B.A.), but usually smaller with all spirals (9 above, 16 below peripheral) accentuated and somewhat serrate; peripheral carina much stronger, produced on antepenult whorl into 17 serrations which overlap suture, on penult into 24 even larger ones but on last whorl becoming more nearly uniform; with three, wide, orange-red bands, of which lower two are sometimes (in type) confluent; peristome thickened internally so that the face of its reflection is concave and almost in plane of aperture, angulate at peripheral carina. Alt. (of type male) 7.1 mm., maj. diam. 120 (8.5 mm.), min. diam. 91 (6.5 mm.), with $1\frac{1}{4}$ (sutural) and $4\frac{1}{4}$ post-embryonic whorls.

Type locality (ANSP. 162733): on drier, chalky underside of rocks in canyon-like gully, Portland (EEJb). This subspecies approaches *E. josephinae* (C.B.A.), but is a smaller, higher shell with the carinal serrations much less prominent on its last whorl.

E. nobilis retreatensis, new subspecies.

Females averaging about as large as males of *nobilis,* subangular (instead of evenly rounded), with spiral threads (10 above and probably 35 below although only first 10 are fairly distinct) becoming stronger and more discrete towards periphery, on which 3 spirals coalesce intermittently into about 16, oblong, white calli; two orange-red bands (absent in *nobilis*) represented by a series of 6 to 8 big, oblong blotches above and another row of about 12 smaller ones between peripheral calli, but not visible on lip, which is narrowly reflected (like in *nobilis*). Alt. (of type male) 13.7 mm., maj. diam. 110 (15.1 mm.), min. diam. 95 (13.1 mm.), with $1\frac{1}{4}$ (sutural) embryonic and $5\frac{3}{4}$ post-embryonic whorls.

Type locality (ANSP. 162734): WWF. This race slightly approaches the carinate *E. chittyana* (Pfr.).

Helicina neritella Lam., subarboreal, young shells with short, irregularly spaced, epidermal ridges in a spiral direction, including typical race [EBL, EEC, EEJ, EJ, ENF, KH] and race *reducta* A. J. Wagn. [KHW, ML2, MM1–3, NM2, NMV]); subsp. *diplocheila* A. J. Wagn. + angulata C.B.A., subarboreal [VCM, VW1, WC2, WCC]; *H.* (*Ampliata*) *jamaicensis* Swby. + *H. ampliata fuscocallosa* A. J. Wagn., good climber [ML1, MM3, MN, NM, VW2, WV, WC1, WWF; with close spirals of ex-

tremely short hairs]. Females usually larger than males in both species.

Alcadia major (Gray), rock-bases, including typical [ML1-fresh, MN2, 3, NMM, NM2] and approaching *gossei* [NMV]; subsp. *gossei* (Pfr.) [VF-subfossil, VW2, WV-dead]; *A. albolabris* (C.B.A.), fair tree-climber [ML1, MM3]. Both species develop very short, subequal, deciduous, epidermal hairs, which form close rows (more distant in *albolabris*), both spirally and along growth-lines. In all the Jamaican species of *Alcadia,* the females are usually larger.

A. (*Idesa*-like) *megastoma* (C.B.A.), fair tree-climber [EJ2, 3, ENF; smooth and shining; red tinting usually apical, very variable in extent]; *A. affinis* (C.B.A.), big subsp. [EBL-fresh; = *gloynei* (Bld.) ?]; *A. solitaria* (C.B.A.) [KHWa-fresh]; *A. dubiosa* (C.B.A.), ground, incl. typical [WWC (incl. albino shell), WWF, WC2; epidermis with low, wavy, spiral ridges] and appr. *intermedia* (C.B.A.) [VF-fresh].

A. (*Palliata*) *brownii* (Gray) [VF-dead]; subsp. *palliata* (C.B.A.), fair climber [MM3, 4, MN, VW1, 2]; subsp. *labiosa* (C.B.A.) [NM]; *A. microstoma* (C.B.A.), fair climber [NMV; with whitish band below suture and hairs longer than preceding]; *A. hollandi* (C.B.A.), weak climber, mainly ground [ML1, MM4, MN1, 3, NMM, NM2a (some yellowish with pink apices), NMV, VW2]. Epidermal hairs in this group similar to those in typical but with two rows of long hairs above and below notch and its groove.

A. (*Palliata*) *pusilla* (C.B.A.), mainly ground [MN3; very long hairs absent; middle-sized stout and widely spaced except in row below notch]; *A. macilenta* (C.B.A.), ground [EBL, EEJ; major hairs conspicuous]; *A. consanguinea* (C.B.A.), fair climber [WSF; with much shorter hairs than next]; *A. hirsuta* (C.B.A.), fair climber [EEJ, EJ1–3, EJF; major hairs very long and heavy]. Epidermal hairs in this group longer in each 2nd or 3rd spiral row and usually still longer in 7 rows; a subsutural row, 2 at periphery, 2 on umbilical side and 2 above and below notch and its groove.

Lucidella aureola (Fér.), subarboreal, males usually smaller,

incl. typical race with more widely spaced spirals and commonly of typical greenish-yellow color-form [EBL, EEC (often dwarfed, mainly greenish, EEJ (mainly greenish), EJ, ENF, KC1, KF, KH], Mandeville race with close spirals, rarely greenish [ML, MM3, 4, MN3 (yellow), NMM, WWF] and dwarf race [VCN, WV (some greenish), WC1, WWF]; subsp. *montegoensis* Br. [VCM; red and reddish-green]; *L. granulosa* C.B.A., subarboreal, males smaller [MM2–4, MN]; subsp. *undulata* Pfr., incl. typical carinate race [NM2, NMV] and approaching *interrupta* Simps. [VWS, VW1, 2; carinate but radial undulations progressively weaker; also approaching uncomfortably close to *montegoensis*]; *L. inaequalis* Pfr. good climber, males smaller [WWC; yellowish and red color-forms].

L. (*Poenia*) *depressa* (Gray), ground, males and females subequal [KF, KHW; hairs of medium length, quite distant, arranged in rows parallel both to growth and spiral lines; incl. one albino]; subsp. *valida* (C.B.A.), ground [EEJ, EJ1, 3; hairs longer; shell more globose, bright reddish; scrobiculation prominent]; *L. coronula* (Pfr.), ground, males larger [MN3b, c; hairs very long and most widely spaced]; *L. adamsiana* (Pfr.), ground, females larger, including typical [MM4, MN, NMM, NM2a, b, NMV, VF-fresh, VW1, 2, VWS; hairs shortest and most closely spaced along spirals] and dwarf coastal form [KHS, WC1, WWF]; subsp. *sublaevis* H.B.B., ground, males and females subequal, incl. typical albino [MN3b, c] and colored forms [MM2, 3b, c, NM2b, NMT].

L. (*Perennà*) *lineata* (C.B.A.), ground, males smaller, including typical race with more widely spaced, stronger spirals [EEJ, EJ2, 3, EJF; what I take to be Adams' types come from St. Davids] and Mandeville race with more closely spaced, finer spirals [MM3c, MN1, 3a]; *L. persculpta* Pils. & Br., ground, males smaller, incl. typical [VCMb–d; with epidermal ridges surmounting major spirals] and probably distinct subsp. [WWF; one small, more elevated shell, with many basal spirals]; *L. foxi* Pils. [EEC, EJF, ENF].

The genus *Fadyenia* (= *Stoastoma* minus *Stoastoma* s.s.) has a radula with comb-laterals and without unicuspid marginals; it

is, I suspect, more closely related to *Lucidella* and *Ceratodiscus* than to *Stoastoma* and *Stoastomops.* The "species" have been grossly overdescribed; identification of Chitty's names must await comparison of his types (too often "unique") with series of fresh, unworn shells.

Fadyenia (*Lewisia*) *agassiziana* (?) *adamsiana* (Ch.), rock-bases [VCMb, c, WCC-dead; compared with worn shells probably from Chitty; calcareous operculum with very large inner tongue like in (subfossil) type of *F. philippiana* (C.B.A.); largest shell with maj. diam. 2.8 mm. (type of *agassiziana* not seen); tongue-shaped expansion of umbilical lamella, which is very fragile and easily broken away, quite variable, sometimes almost horizontal but usually curved upwards and rarely almost touching penult whorl (broken away from types of *philippiana* but certainly never soldered in paratype; third shell a *Proserpinula*!); fresh shells rather clean, 6 ribs with epidermal expansions like in *Lucidella persculpta*].

F. (*Blandia*) *gouldiana* (C.B.A.), rock-bases [MN3c, young; 9 ribs with epidermal expansions]; *F. hollandiana* (C.B.A.), paedogenetoid subspecies, rock-faces [VCMb, c, VF; as small as maj. diam. 1.3 mm. with ½ whorl less; may be *B. hilliana* Ch. and *W. bensoniana* Ch.]; *F. blandiana* (C.B.A.), rock-faces, incl. fairly typical [KHS, KHW; Adams' types (2) seen] and one larger shell [KHW-dead; maj. diam. 2 mm., with ½ more whorl, 5 + 32 spirals and last ⅛ whorl solute, which makes a very depressed shell]. Typical *Wilkinsonaea* has an operculum approaching that of *Lewisia,* but *Blandia,* the 2nd group of *Wilkinsonaea* and *Petitia* (radula unknown) are often not even specifically separable. The subdiscoid to globose-subdiscoid shells keep relatively clean and develop 5 (typical) to 9, brownish, epidermal expansions on major spirals, which in worn shells (*Blandia* s.s.) may be scarcely stronger than the interstitials.

A second paper of this series will appear in the near future.

PLIOCENE FRESH-WATER FOSSILS OF THE KETTLEMAN HILLS AND NEIGHBORING CALIFORNIAN OIL FIELDS

BY H. A. PILSBRY

Some time ago a collection of these interesting fossils was received from Mr. Stanley Siegfus, of the Shell Oil Company, with a request that they be reported on. An illustrated account has been prepared, but owing to causes beyond my control, publication has been delayed; it is expected to appear in the autumn. Meanwhile the following brief notices are given for temporary reference.

Goniobasis kettlemanensis woodringi, n. subsp. Similar to the type except that the whorls are more convex, and the spire has weak axial plication. It is from a higher zone, the basal Tulare formation.

G. arnoldiana, n. sp. Smooth except for some growth wrinkles, with rapidly tapering spire, attenuate above, and tapering faster than in *G. nigrina.* 14 × 7.2 mm., apert. 7 mm., or larger.

Calipyrgula, n. gen. (Hydrobiidae.) Minute, very slender, perforate, with slightly obtuse apex and strongly convex whorls, spirally striate. Type *C. carinifer.*

C. carinifer, n. sp. Shell carinate from the third whorl. 3.9 × 1.5, apert. 1 mm.; 7 whorls. 2.1 × 0.9, apert. 0.65 mm., 5½ whorls.

C. ellipsostoma, n. sp. Similar, but with rounded whorls which are less convex and a little longer, very weakly striate spirally. 3.4 × 1.2, apert. 1 mm.; 6½ whorls.

Pyrgulopsis vinctus, n. sp. Smaller than *P. nevadensis,* with a wider umbilicus; smooth. 3.7 × 2.2 mm., apert. 1.25 mm.; 5½ whorls.

P. polynematicus, n. sp. Shorter than *P. vinctus,* with a keel at shoulder and finely striate spirally; umbilicus moderately wide. 2.25 × 1.66 mm., apert. 1.1 mm.; 4½ whorls. Button-willow gas field, 2649 to 2660 ft.

Fluminicola kettlemanensis, n. sp. Imperforate or nearly so, resembling *F. virens* (Lea), but with a shorter aperture. 7.7 × 5.4 mm., apert. 4.2 mm. San Joaquin formation outcrop.

F. pilula, n. sp. Subperforate, nearly sphaerical, with very short, conic spire. Convexity of last whorl greatest near the suture; smoothish, with microscopic spiral striae. Columella

and parietal wall rather heavily calloused. 4.5 × 4.3 mm., apert. 3.25 mm. Lost Hills oil field, 435–445 ft.

F. siegfusi, n. sp. Globose, imperforate, the early whorls nearly in a plane, the apex slightly concave. Surface smooth. Columella and parietal margin very heavily calloused. 3.25 × 3.2 mm., 4½ whorls. Same loc., 365–720 ft.

F. spiralis, n. sp. Globose-conic to ovate-conic, perforate, rather thin, the apex only slightly obtuse; whorls convex, with delicate growth lines and minute engraved spiral lines. Columella very lightly calloused. 4.25 × 3.4 mm., apert. 2.25 mm. 23 miles southeast of Hanford, 772–792 ft., and in the McKittrick Front oil field.

F. perditicollis, n. sp. Globose with very shortly conic spire, smooth, the aperture rather strongly oblique, columella and parietal margin rather heavily calloused. 6.2 × 5.2 mm., apert. 4.7 mm.; 5 whorls. Lost Hills oil field, 455–650 ft.

F. percarinata, n. sp. Imperforate, trochiform, with a median keel on the last whorl, which is flattened above and below it; apex flattened. Columella rather heavily calloused. 4.8 × 4.3 mm., 4⅔ whorls. Same loc., 445–520 ft.

Brannerillus involutus, n. sp. Rather narrowly umbilicate, globosely truncate-conic with rounded periphery and very obtuse summit, the apex sunken; 3 whorls visible in a front view; smooth. 2.8 × 2.25 mm., apert. 1.45 mm., 4 whorls. Kettleman Hills, Sec. 30–21–17, outcrop of basal Tulare formation.

In the form *B. i. praeposterus,* n. subsp., the spire shows only 2 whorls in front view, and the summit is flat or convex, not sunken. It is also smaller.

Littoridina woodringi, n. sp. Narrowly perforate, acutely oblong-conic, the spire straight sided or slightly attenuate above, the whorls only moderately convex, smooth; aperture oval. 3.4 × 2, apert. 1.35 mm.; 5½ whorls. E. side Middle Dome, Kettleman Hills, 350 ft. above the base of the Tulare formation.

Amnicola hannai, n. sp. Narrowly umbilicate, acutely ovate-conic, the spire straight sided, of 5 strongly convex short whorls; smooth; aperture oval. 2.7 × 1.8, apert. 1.1 mm. Many specimens (males?) are more slender, 2.5 × 1.5 mm. It is smaller than *A. longinqua* Gld., which is abundant in the Kettleman Hills Pliocene, with more acute, straightly conic spire.

Valvata densestriata, n. sp. Similar to *V. h. californica,* but the whorls increase more rapidly in caliber, and the surface is very finely, closely and sharply striate. 4.2 × 4.5 mm., apert. 2.4 mm.; 3½ whorls. Well about 23 miles southwest of Hanford, 772–792 ft.

Helisoma (?) *kettlemanensis,* n. sp. Minute, resembling *H. anceps* (Mke.) in general form except that it is not carinate; left side more deeply and narrowly umbilicate than the right, periphery rounded; aperture large, oblique and triangular-lunate. Diam. 2.8 mm., alt. 1.7 mm.; nearly 3 whorls.

NEW LYMNAEIDAE FROM THE UNITED STATES AND CANADA: I. CALIFORNIA, OREGON AND OTHER WESTERN STATES

BY FRANK C. BAKER

When the writer's "Lymnaeidae of North and Middle America" was published in 1911 it was thought that the limit had been reached in the number of species of this family in North America. The more conservative critics of this work believed that too many species had been admitted as recognizable, and that in time some of these would become synonyms. Such, however, has not been the case, for during the twenty-two years which have passed since its publication nearly a dozen new species and races have been added. Studies on material recently received from Canada and the western United States indicate quite clearly that a considerable number must still be added. It is proposed to diagnose these new forms in a series of papers of which this is the first.

That indefatigable worker and keen observer Professor Junius Henderson has been overhauling the Hemphill and Hannibal collections of fresh-water mollusks in the museum of the Leland Stanford University, and has unearthed a number of Lymnaeas which do not fit into any of the species known at present, and it becomes necessary to affix new names to them.

Stagnicola palustris magister nov. var. Vol. 47, pl. 14, fig. 1.

Shell differing from *S. p. nuttalliana* in being larger, with a longer spire, deeper sutures, the penultimate whorl large and "puffy," the aperture rounder and more or less arched at the posterior angle. There are fully seven whorls. *Nuttalliana* usually has only six full whorls.

Length	Diam.	Aperture length	Width	
38.5	17.0	17.7	9.1 mm.	Holotype.
39.5	19.5	21.0	10.1 mm.	Paratype.
33.0	16.5	17.0	8.8 mm.	"
32.0	15.0	15.8	8.1 mm.	"

Type locality: East Shore Rhett (Tule) Lake, Modoc Co., California, collected by Henry Hemphill. Types: Stanford University, Geological Department, No. 5773.

This is the largest form of the *palustris* group observed in America. It is abundant in Tule Lake and apparently does not occur elsewhere. Its size and general shape are uniform enough to constitute a form or race of *palustris,* a variant evidently from the *nuttalliana* form. Immature and young specimens, 10–13 mm. long and having 4–5 whorls, are in the Hannibal collection. They are like the immature condition of the *palustris* varieties found throughout America.

Stagnicola palustris buttoni nov. var. Vol. 47, pl. 14, fig. 4.

Shell elongated, narrow; whorls 6–7, flat-sided, elongated; suture impressed; spire somewhat scalariform, usually $1\frac{1}{3}$ times length of aperture; body whorl flattened; aperture elongated, almost twice as high as wide; outer lip thin, with faint varix within; inner lip narrow, reflected over columellar region leaving distinct umbilical chink; parietal wall with white callus; color light yellowish horn, surface dull to shining; sculpture coarse, often raised into well marked costae; surface often malleated; columellar plait not well developed.

Length	Diam.	Aperture length	Width	
25.5	10.0	10.5	4.9 mm.	Holotype.
25.6	10.8	11.0	5.4 mm.	Paratype.
21.5	8.8	9.0	5.0 mm.	"
28.6	12.0	14.5	7.0 mm.	"

Type locality: Near Salt Lake City, Utah, collected by Henry Hemphill. *Types:* Stanford University, Geological Department, No. 5774.

This form or race is related to *S. p. wyomingensis* F. C. Baker, differing in its longer spire with higher whorls which are flat-sided, not rounded. The body whorl is very flat-sided, the aperture long and narrow, there is a distinct umbilical chink, and the

sculpture is coarser than in *wyomingensis*. This form was found in the Hemphill collection labeled "*Galba proxima buttoni* Baker" and it is evident that the writer gave specimens this name when the Lymnaeidae monograph was in preparation. It was evidently forgotten in the final draft of the work. It is a characteristic and easily distinguished variety of the prolific *palustris* group.

Stagnicola hemphilli sp. nov. Vol. 47, pl. 14, fig. 7.

Shell ovate, light horn color, shining; whorls 6, flatly rounded, sutures well marked; spire short, acute, pyramidal; body whorl wide, convex; aperture long ovate, narrowed above, rounded below, about as long as the spire; outer lip well rounded, with a red varix near the edge within the aperture; inner lip rather wide, erect, emargining the well marked umbilicus; columellar plait not distinct, often absent; a more or less distinct callus on the parietal wall; the spiral sculpture of impressed lines is distinct and there may be raised vertical costae or the shell may be malleated.

Length	Diam.	Aperture length	Width	
18.0	9.1	9.1	4.8 mm.	Holotype.
20.2	10.2	10.3	5.1 mm.	Paratype.
20.3	10.0	10.6	5.0 mm.	"
16.2	8.0	8.2	4.2 mm.	"

Type locality: Near Salt Lake City, Utah Co., Utah, Hemphill collection. *Types:* Stanford University, Geological Department, No. 5775.

This neat species somewhat resembles short forms of *Stagnicola traskii* (Tryon). It differs markedly in its more spindle-shaped form, the spire and aperture being equal in length, the aperture not rounded but elongate-ovate, the body whorl is not obese, the spire whorls are not elongated, and the inner lip is wider and in most specimens emargines the umbilicus. The color is different, a darker horn sometimes purplish. The species belongs in the series of forms erroneously placed under *traskii* in the Lymnaeidae Monograph, p. 368, and appears to be the same as the specimens figured on pl. 39, figs. 7, 8, from Black Rock Butte, Sweetwater Co., Wyo. (coll. Walker, 13506). The specimens from Alberta represent another species which will be diagnosed in another paper.

Stagnicola impedita nov. sp. Vol. 47, pl. 14, fig. 3.

Shell much elongated, narrow, of 6–6½ loosely coiled, flat-sided whorls; spire very acute; sutures deeply indented; body whorl flattened, elongated; aperture less than half the length of shell, elongate-ovate; outer lip without marked varical thickening; inner lip narrow, appressed at its junction with parietal wall forming a slight plait; umbilical chink small; surface shining, sculpture of fine growth lines crossed by fine spiral impressed lines; there is a wash of callus on the parietal wall.

Length	Diam.	Aperture length	Width	
16.5	6.1	6.3	3.0 mm.	Holotype.
16.0	6.1	6.2	3.0 mm.	Paratype.
15.7	6.0	7.9	3.2 mm.	"
13.2	5.2	6.0	2.5 mm.	"

Type locality: Near Logan, Cache Co., Utah, Hemphill collection. *Types:* Stanford University, Geological Department, No. 5776.

This small lymnaeid bears the most striking resemblance to *Stagnicola kirtlandiana* (Lea), and was so labelled in the Hemphill collection. It differs from Lea's species in being smaller, the whorls are not as long, not as rounded, sutures less deeply impressed, body whorl wider, aperture more ovate, columellar plait less marked, and sculpture much finer. The two species appear to be almost parallel in development although inhabiting widely separated areas.

THE POLYGYRA TRIDENTATA COMPLEX

BY A. F. ARCHER

Outside of the section *Stenotrema* few groups of *Polygyra* give more trouble in identification than the *Polygyra tridentata* complex. This complex belongs in the section *Triodopsis*. An examination of material that from time to time has come into the collection of the Museum of Comparative Zoology, Cambridge, Massachusetts, shows that there has been uncertainty and confusion in the determination of the species contained in this group. This is due both to the difficulty of naming, and to the uncertain application of names that existed in the latter half

of the last century. Anyone who has such material straight from the field should exercise the utmost care in sorting and studying it before determination. A superficial glance is not always sufficient in recognizing the true differences existing in these forms.

Dr. Pilsbry has rendered great service to the study of these forms by detecting important and consistent differences between the various species and varieties of this group, which had hitherto been overlooked. He classified and named many new forms, and established the true status of several others. A large collection of these forms shows that they are worthy of study from the point of view of geographical distribution, and it is there that the value of differentiating them is most evident.

Many of the species belonging to the complex have a wide range of distribution. They are for the most part fairly small snails, and their shells are usually characterized by tridentate apertures. These armatured apertures serve as protective devices against the attacks of carnivorous beetles, and even against other molluscan enemies such as *Haplotrema concavum* (Say). The form and arrangement of these apertural teeth are some of the most important characters for differentiating the species, and seem to express very clearly their innate differences. These snails are ground livers, and are found among the leaves and humus in open woods and wooded hillsides. In favorable localities they may often be found in great abundance.

Their radulae, using *P. tridentata* as an example, bear rather long central teeth, and the outer marginal teeth are bifid. In the genitalia the penis is rather long with a terminal retractor muscle, and the vas deferens enters near the summit. The spermatheca is small and globular, while its duct is long and rather large at the base. The shell is umbilicate and either globose or depressed. Very few malformed individuals are encountered. The most common malformation is a misshapen peristome.

The purpose of this paper is to deal with the various species in the group, and to attempt to show their geographical distribution. Many of the names of these forms have been scattered through the literature. They will here be brought together, and

defined. The definitions will deal chiefly with their distinguishing characteristics, so that the identification of them may be rendered easier. The species included here are those inhabiting the area extending from the Atlantic coast as far west as the western border of the Mississippi Valley. No related forms occurring outside of those limits are dealt with here. Dr. Pilsbry has very kindly lent paratypes of several forms for examination and figuring.

Section Triodopsis Rafinesque

Group of Polygyra tridentata

1. *Polygyra tridentata* (Say)
2. *Polygyra tridentata juxtidens* Pils.
3. *Polygyra tridentata tennesseensis* W. & P.
4. *Polygyra tridentata complanata* Pils.
5. *Polygyra tridentata edentilabris* Pils.
6. *Polygyra fraudulenta* Pils.
7. *Polygyra fallax* (Say)
8. *Polygyra fallax goniosoma* Pils.
9. *Polygyra vannostrandi* (Bland)
10. *Polygyra vannostrandi alabamensis* Pils.
11. *Polygyra hopetonensis* (Schutt)
12. *Polygyra hopetonensis charlestonensis* Maz.
13. *Polygyra hopetonensis obsoleta* Pils.

The first reference under each species is the original citation. Additional references are given for critical notes and figures. Specific localities cited are for the specimens figured.

1. Polygyra tridentata (Say). Pl. 1. fig. 1, near Wissahickon Creek, Chestnut Hill, Philadelphia.

Helix tridentata Say, Nicholson's Encycl. 4, pl. 2. f. 1 ("inhabits the middle states").

Triodopsis tridentata Say, W. G. Binney, 1885, Man. Amer. Land Shells, p. 291, f. 312.

Polygyra tridentata Say, Pilsbry, 1894, Proc. A.N.S.P., p. 19, pl. 1, f. 7.

The shell is depressed, umbilicated, chestnut to light horn color, and covered with raised axial ribs. The number of whorls varies from $4\frac{3}{4}$–$5\frac{3}{4}$. Besides its flattish shape it may be distinguished by the following characteristics. *The aperture bears three teeth. The marginal tooth is situated on the upper* half

of the peristome. The basal tooth is situated more than halfway toward the outer margin of the peristome. Both teeth are simple and acute. The parietal tooth is oblique and strong.

The figured specimen is chosen because it is typical of Say's species. There is a wide range of variation in the species throughout its geographical range. Numbers of geographical races exist. This species has the widest range of any species in the group. It is found in Vermont, northern New York and Ontario Province, Canada, and extends southward into northern Georgia and Alabama. It is found in eastern Iowa and ranges clear across the country to the Atlantic coast. It is virtually absent in most of New England except the extreme west. In the South it occurs throughout the mountains, but is absent in the coastal region. Throughout the northeastern range of the species the forms are of medium size (about 15 mm. in diameter). They are inclined to be chestnut colored, and the peristome is often pinkish. The distribution in Virginia is limited to the western part of the state, where puzzling forms occur. In Rockbridge County rather large heavy specimens are found while in Roanoke County small, flat, weak toothed forms occur. The forms of North Carolina are also dark colored, but are larger than those of the more northern regions. Slightly smaller but otherwise similar forms occur on the Tennessee slope of the Appalachian Mountains. The species is absent in the western half of Tennessee. It ranges throughout Kentucky, and here we find very depressed light colored shells, some of which measure 20 mm. in diameter, while in several localities heavy specimens exist. The species occurs throughout the Middle West, east of the Mississippi, and is especially common in Indiana, though rare in Michigan. The shells found in this region are medium sized and usually rather dark. The localities in northern Georgia and north Alabama yield specimens similar in appearance to those of the Appalachian Region.

It must be concluded from this that *P. tridentata* is a successful species, capable of existing in a wide area, and under varied conditions. It is most common in open woods, among leaves or rocks. It does not seem partial to any particular type of geological formation, for it is found equally among limestone rock

in some regions, and sandstone or granitic rock in other regions. Few Polygyras, with the notable exception of *P. thyroidus* (Say), are more adaptable to various climates and regions than *tridentata*. It is, however, obvious that it has not survived this great variety of conditions without variation taking place.

2. Polygyra tridentata juxtidens Pilsbry, 1894, Proc. A.N.S.P., p. 20, pl. 1, fig. 8. (Cave Town, Md.).

The shell is quite exactly like *P. tridentata* in external appearance. It is readily distinguished in tooth structure. *It differs from tridentata in having the marginal tooth situated at least halfway down the peristome towards the base, near the basal tooth. The parietal tooth slants toward it or just above it, while in tridentata it slants below it.*

The geographical range of *P. tridentata juxtidens* is somewhat more extensive than that of *P. tridentata*. It occurs in Northern and Western New England and extends southwestward to Eastern Iowa and Eastern Missouri. It is absent in Ontario Prov., Canada, Michigan and the northern half of the middle states. It has not been reported from the western slope of the Appalachian Mountains except in Nicholas County, Kentucky. It is almost absent in the mountain region of North Carolina where *tridentata* is common. However, the region lying east of this it is present to the exclusion of *tridentata*. It likewise supersedes the straight species in the New Jersey area, but is less common in Maryland. Just south of the Potomac River it again outbalances *tridentata*. The small or medium sized dark form is characteristic of the northeastern area of Virginia. The typical forms occur in northern Virginia and northern West Virginia, one of which is figured. Large heavy specimens occur in Rockbridge County and Roanoke County, Virginia. Fairly typical forms are found in central North Carolina and South Carolina. Unusually broad lipped specimens have been taken at Eutaw Springs, Berkeley, Co., South Carolina. Examples from Northern Alabama are frequently large and flat. Fairly typical specimens have been collected in eastern Iowa and eastern Missouri.

An interesting geographical race occurs in the southern half of the middle western states especially Indiana and Ohio. This

race is characterized by being horn colored, broad, and more compressed than the typical form. The shell is quite shiny, and the striae are less pronounced than in the typical. Pilsbry named this form *Polygyra tridentata discoidea* (Pilsbry 1904, Nautilus *17,* p. 142). It seems inadvisable to consider this apart from *juxtidens,* of which it seems to be a geographical race. It exactly corresponds in tooth structure, general character of the sculpture, etc. One set from Cincinnati, Ohio, has the tooth structure of *P. tridentata,* but otherwise is like the race mentioned above. This must be considered as *tridentata* despite that fact. The same form of *tridentata* also occurs independently in Central Kentucky.

3. Polygyra tridentata tennesseensis Walk. & Pils. Plate 1, fig. 3, Concord, Anderson Co., Tenn. Diam. 19.5 mm.

Polygyra tridentata tennesseensis Walker & Pilsbry, 1902, Proc. A.N.S. Phila,, p. 422. (South side French Broad R., below Paint Rock, Tenn.) Walker, Terrestrial Shell-bearing Moll. of Ala., Univ. Mich. Mus. Zool. Misc. Publ. No. 18, p. 22.

The shell is large (diameter 22–24 mm.) rather flat and is similar to *P. tridentata* in coloring and sculpture. *It is different in being consistently larger, while the marginal and basal teeth though typically situated are smaller. The parietal tooth is sharper and more prominent.*

This variety is peculiar to the Eastern Tennessee and the Northern Alabama region where it replaces *P. tridentata.* It is not very variable in size and color, but on the northern and eastern periphery of its range forms have been found which are intermediate between it and *P. tridentata.* In the center of its range the forms are quite distinct from any other related forms.

4. Polygyra tridentata complanata Pils. Pl. 1, fig. 4. Burnside, Pulaski Co., Ky. Diam. 21 mm.

Polygyra tridentata complanata Pilsbry, 1898, Nautilus, 12, p. 22. (Burnside, Ky.)

The shell in appearance quite suggests the forms of *P. tridentata juxtidens* from southern Ohio and southern Indiana. Like them the shell is large (diam. 21–23 mm.) and shiny. *It differs in being flatter and more openly umbilicate. The marginal and*

basal teeth are almost absent, mere slight traces appearing in the same positions as those of typical P. tridentata. The parietal tooth is smaller and sharper.

This form has only been found in south-central Kentucky. Exceptionally small specimens (diam. 17 mm.) have been found in Casey County, but aside from their size they are quite typical.

5. POLYGYRA TRIDENTATA EDENTILABRIS Pils. Pl. 1, fig. 5. Cumberland Mts., Tenn. Paratype. Diam. 12 mm.

Polygyra tridentata edentilabris Pilbry 1894, Nautilus, 7, p. 140. (Cumberland Mts., Tennessee.)

The shell resembles that of *P. tridentata.* It is small (diam. 12 mm.) and is shaped exactly like small specimens of *tridentata. It differs in the entire absence of the marginal and basal teeth.* It is yellow horn colored, with a whitish peristome.

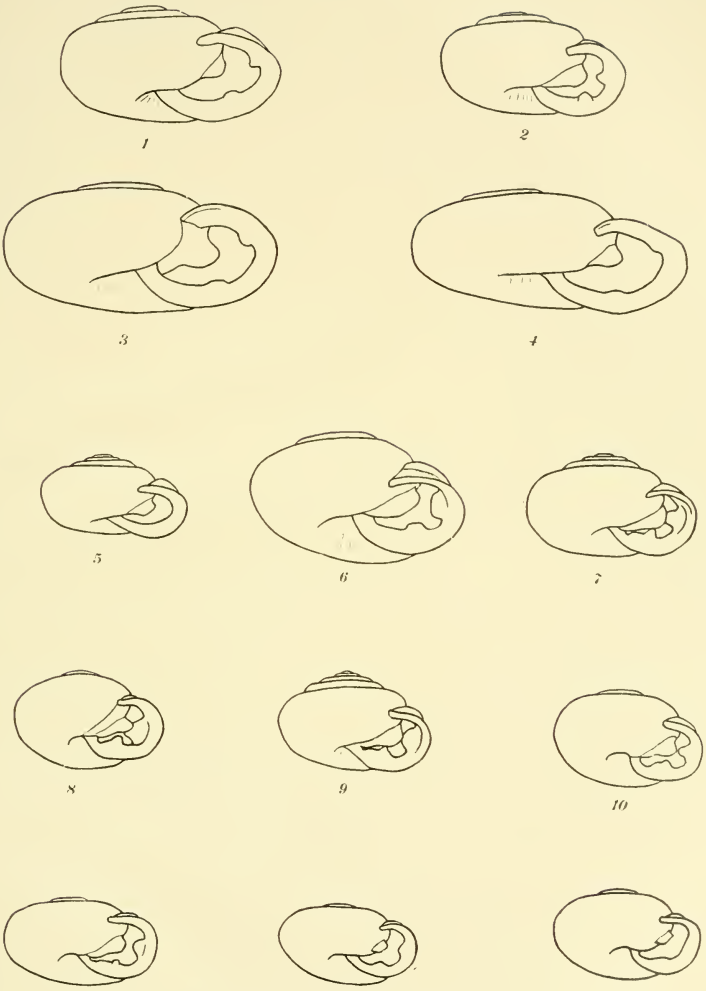
This apparently rare form comes from the Cumberland Mountains, Cumberland plateau region, central Tennessee. It is a remarkable form, contrasting with *P. tridentata tennesseensis* of the surrounding country. This species contrasts also with *P. tridentata complanata* in its small size and rugose appearance. Both forms are virtually toothless, but this does not necessarily indicate a close relationship. The figured specimen is a paratype sent by Dr. Pilsbry for examination.

(To be continued)

NOTES ON THE LIFE HISTORY OF PLEUROCERA CANALICULATUM UNDULATUM SAY

BY SAMUEL R. MAGRUDER
Department of Zoology, University of Cincinnati

For the past two years the writer has been making some anatomical studies on the fresh-water gastropod, *Pleurocera canaliculatum undulatum* Say, during which time numerous collections have been made from one vicinity. All the animals studied have been taken from the Licking River at or near the town of Butler, Kentucky. Although no regular population samples have been taken for life history work certain facts have



1. Polygyra tridentata Say. 2. P. t. juxtidens Pils. 3. P. t. tennesseensis W. & P. 4. P. t. complanata Pils. 5. P. t. edentilabris Pils. 6. P. fraudulenta Pils. 7. P. fallax Say. 8. P. f. goniosoma Pils. 9. P. vannostrandi Bland. 10. P. v. alabamensis Pils. 11. P. hopetonensis Shutt. 12. P. h. charlestonensis Maz. 13. P. h. obsoleta Pils.

been observed which seem to corroborate the work of Van Cleave (NAUTILUS, Vol. XLVII, No. 2) on life history studies of *Pleurocera acuta* Rafinesque. As so little is known concerning the life history and development of members of this family it seems worth while to record any new observations.

During late winter and spring collecting, the absence of shells of this species under 8 to 10 mm. in length was very noticeable. Also during spring collecting, very large living individuals were very rare although large dead shells were fairly common. The average shell length for members of this colony is from 17 to 20 mm. During late September and October, collections were made. At this time, the youngest individuals which have been seen were collected. The eggs of this species have not been recorded. The shell of the smallest individual was 4.0 mm. long by 2.6 mm. wide and collected on October 21. Shell lengths of some other young specimens collected at the same time were 4.4, 5.2, 5.6, 6.1, 7.0 and 8.7 mm. Animals with shell lengths greater than these were common and animals with shell lengths 14 to 18 mm. were abundant. It is believed that the apparent rareness of the very young individuals is because they are so easily overlooked due to their small size as suggested by Van Cleave. The presence of young individuals varying greatly in size in the early fall would seem to indicate an egg laying season extending over several months, as pointed out by Van Cleave for *Pleurocera acuta* Rafinesque.

However, the situation is complicated by the fact that occurring with Pleurocera in the same location is another gastropod, *Lithasia obovata* (Say) in even greater numbers. Animals of the latter with shell lengths less than 6.2 mm. have not been found by the writer. There is a possibility that the specimens mentioned above may be *Lithasia obovata* (Say) ; however, judging from their appearance, it is not at all probable. The young shells described as Pleurocera have the typical rhomboidal aperture of the genus and the color and shape, especially of the body whorl are almost identical with that seen in the adult of the same species, the eroded spire being excepted. On the body whorl the shell is sculptured by very fine spiral lines crossed by somewhat heavier growth lines. The color of the smallest specimen is a uniform tan.

Collected at the same time as the above specimens were the largest living adults yet seen and which were fairly abundant. The largest specimen collected by the writer from this colony had a shell length of 26.4 mm. and a width of 11.3 mm. When these very large individuals are brought into the laboratory they die very soon, usually surviving less than a week although receiving the same care as smaller (younger?) individuals which usually lived for quite a while. There may or may not be a factor of old age concerned. Nothing is known of the length of the life span of this animal, but these facts together with the scarcity of living individuals and comparative abundance of large dead shells in the spring would suggest that, regardless of the length of the life span, the natural termination of life due to old age occurs in the late winter.

The writer is indebted to Mr. Calvin Goodrich for identification of both gastropods mentioned.

A NEW FLORIDA PEARLY FRESH-WATER MUSSEL

BY BERLIN HART WRIGHT

Elliptio maywebbae, new species. Vol. 47, Pl. 13, figs. 5–8.

Shell unusually inequilateral, epidermis reddish to horn-colored, smoothish, with growth ridges scarcely distinguishable, umbonal ridge snout prominent but clearly biangulate and curved. Rayless, sides well rounded, almost to the point of inflation. Dorsal or hinge margin short and prominently arcuate, which feature is accentuated by the inconspicuous umbos and the abrupt depression of the posterior-dorsal margin. This gives a decided falcate outline to the mature male shells, with excurvate ventral margins. Abruptly rounded posteriorly and somewhat more pointed behind. Beaks acute but not prominent, beautifully sculptured with double looped sharp ridges which are abruptly and prominently angled at the umbonal ridge, making a row of knotty tubercles following down the ridge as far as the loops extend. Nacre dark coppery (flesh-colored) in some of the paratypes, and highly iridescent. Teeth double in the left valve and single in the right one; laterals arched, sharp and thin, and cardinals very oblique. Pallial impression and scars or cicatrices all slightly impressed. Abductor scars confluent, generally. Shell and beak cavities shallow and beak cicatrices

deep and crowded up close under the collar of the lateral teeth. Soft parts unknown.

Dimensions: Length 51 mm., altitude 28 mm., diameter 21 mm.

Habitat: Near Seminole Springs, 15 miles southeast of Eustis, Florida. Ex. Coll. Walter F. Webb, Rochester, N. Y.

Observations: This unique Florida mussel must be placed in the *Elliptio* division, probably best as a subgenus, as it is unusually arched dorsally and sculptured at beaks. One dozen specimens have been carefully compared and it is not possible to make any decision as to its relationship. Perhaps it belongs in the *dorsatus* group.

We take peculiar pleasure in naming this shell in honor of the gracious wife of Walter F. Webb, who for more than forty years has been of inestimable help in his conchological work. It was collected by T. H. Van Hyning.

Type in the U. S. National Museum, No. 425354; paratypes with the following museums: The Academy of Natural Sciences, Philadelphia, No. 162516; Museum of Comparative Zoölogy, Boston, Mass.; Buffalo Museum of Natural History, and collection of Walter F. Webb, Rochester, N. Y.

BOSTON MALACOLOGICAL CLUB

The Boston Malacological Club held its regular meetings during the season of 1933–'34, on the first Tuesday evening of each month, from October to May, inclusive, in the Library of the Boston Society of Natural History.

The first meeting was given to experiences in collecting during the past summer. Among these, Mr. William J. Clench described covering some 5,000 miles in Georgia, Alabama and Mississippi; and a 700-mile cruise along the Florida coast, the previous April. Mr. S. N. F. Sanford told of collecting on the New England beaches, and emphasized the fact that after a heavy storm more is to be found by waiting one or two days than by collecting directly the storm is over. Prof. Balch reported finding many nudibranchs, including one new species, at Cranberry Island, near Mt. Desert, Maine.

In November the Club heard a talk on "A Naturalist's Impressions of Australia" by Dr. W. E. Schevill, who had lately spent some months there, in a successful quest for fossils. While he touched only indirectly on mollusks, he described vividly the topography, flora and fauna of this largest of the world's islands. Fine lantern slides added to the interest of his talk.

Dr. Charles H. Blake, of Massachusetts Institute of Technology, spoke in December, his topic being "The Eggs of Freshwater Snails," illustrated by slides from his drawings made in the laboratory, where observation of the eggs and the hatching of the young snails could be conducted to the best advantage.

In January Dr. Joseph C. Bequaert, President of the club, told of visits to malacological collections in England, France, Holland, Belgium, Denmark, Germany and Sweden. The February meeting was announced as a symposium on the "Care and Arrangement of Conchological Collections." An interesting fact called to the attention of the members was that oak, used for cabinets, gives off an acid which in the course of time, coats the shells with an unsightly film which destroys their color and polish.

At the March meeting Mr. Henry D. Russell spoke on "Collecting in Bermuda," telling of both recent and fossil mollusks to be found there, and describing the volcanic origin of the islands, their soil, and their flora.

In April, Dr. Bequaert again addressed the club, this time on "A New Manual of Conchology," the monumental work by Dr. Johannes Thiele, now being published in Berlin. He also touched upon other works on conchology, and gave it as his opinion that in classifying and naming species, more attention should be paid to the shell itself, and less to minute differences in the internal structure of the animal, which he considered had been carried to undue excess during recent years.

At the meeting in May, Mr. Edward M. Howland gave his experiences in collecting in the West Indies, and at Sanibel Island, Florida, and showed an interesting series of shells from these places.

At nearly every meeting, other topics, in addition to those

announced, came up for informal discussion, space permitting the mention of only a few, as the ship-worm and its destructive activities, the disappearance of the eel-grass from New England waters, and the increasing distribution on this side of the Atlantic of *Helix nemoralis*.

At the May meeting the following officers were elected for the coming year:

President	Charles H. Blake
Vice-president	Austin W. Cheever
Conchological Recorder	S. N. F. Sanford
Secretary and Treasurer	Theodora Willard
Executive Committee	Mildred Seymour
	William J. Clench

On May 26, the club held its annual field meeting. This was at Marion, Massachusetts, by invitation of Mr. Howland. Twenty-three intrepid members were not deterred by unpromising weather, and in spite of grey skies and a temperature of only 50°, motored to Marion, to be met there by our host. After spending several hours on the beach, returning with many treasures filling bags and pockets, the members drove to his house, where they were welcomed by Mrs. Howland. Ample justice was done to a delicious luncheon, and then followed an inspection of Mr. Howland's collection of shells, and it was not until mid-afternoon that they started on the homeward drive, all expressing the conviction that it had been the most delightful field meeting ever held by the club.—Theodora Willard, *Secretary*.

CHARLES CURRY ALLEN

Charles Curry Allen, one of the best known and ablest naturalists in the State of Florida, died at his home in St. Petersburg, April 27.

Born in Morrison, Ill., in 1862, where at the age of 10 years he took an interest in fossil shells and the bones of prehistoric animals he gathered together an interesting collection.

His parents did not believe in much schooling but a teacher at Elk Falls, Kans., where he lived at the age of 15 and 16, took a great interest in him and taught him to educate himself. As a result he devoted all his spare time to reading the best books and became a very well educated man. What he read he retained and was ready at all times to get up before an audience and give a good talk on almost any subject.

Well do I remember on one occasion when he and I were down the coast on a collecting trip we chugged over to Cortez for supplies. The storekeeper asked us to attend a political meeting that evening in the hall back of the store. When the meeting was opened and the candidate for Governor introduced, all he said was that he saw in the audience a man much better able than himself to address them and called on Mr. Allen. With his blue shirt, overalls and slippers without socks (we had been sifting sand and mud most of the afternoon) he took the platform and the people listened spellbound at his delivery of facts and statistics given as easy as reading from a printed form. Mr. Allen had previously run for Governor of Florida on the Socialist ticket.

Coming to Florida over 40 years ago he started his shell collection and later opened up a curio shop, giving this up about 15 years ago.

With myself and with others he took many trips to the East Coast, Everglades, Bahamas and Cuba. Several new species of his finding are called Alleni and Curryi in his honor. His series of *Liguus* and the Cuban *Cepolis* and *Polymita* are among the finest.

Collectors who came South were always hospitably received by Mr. Allen, and none went away without benefitting from the visit. He had a host of foreign collectors on his list with whom he exchanged often.

As a man he was always upright, honest and generous almost to a fault. His ideas on peace were so forceful that a plan of which he was the author was read before the Peace Conference at Copenhagen.

Mr. Allen was twice married and a son born from each mar-

riage. These, with the second wife and two sisters, survive him. —D. L. Emery.

NOTES AND NEWS

William B. Marshall, assistant curator of mollusks in the United States National Museum, retired from government service on April 30, at his own request, after serving for more than thirty-two years. Mr. Marshall has been given an honorary appointment, under the Smithsonian Institution, as associate in zoology at the U. S. National Museum.

Physa acuta Draparnaud in Massachusetts.—A series of this species was recently submitted for naming by Mr. C. P. Winsor. These were collected in a tank used to cultivate algae at Harvard University. Several aquarium supply stores in the vicinity of Boston have been selling Australian species of *Bulinus*. It is quite possible that these may become established in our local ponds and streams, as happened in the case of *Viviparus malleatus* Rve.—W. J. Clench.

Planorbis opercularis planulatus in Los Angeles, California.—Some months ago I received from Mr. E. P. Chace a small vial of tiny non-marine shells which he had collected in 1916 in a swamp along Balona Creek near West Adams St. Examination of them revealed the following: *Lymnaea bulimoides cassi* Baker, *Physa heterostropha osculans* Haldman, *Planorbis opercularis planulatus* Cooper, *Succinea oregonensis* Lea, *Succinea sillimani* Bland, *Paludestrina stearnsiana* Pilsbry, *Pisidium*, species undetermined. This is the first record I have known of *P. opercularis planulatus* in southern California. The other species with which it was associated are typical of swampy places in this vicinity.—Wendell O. Gregg.

Dr. Pilsbry and Dr. Francis Pennell are spending the summer in investigating the mollusks and plants of northern Mexico.

Dr. Stanley T. Brooks, Curator of Recent Invertebrates at the Carnegie Museum, Pittsburgh, Pa., will sail in June for several months' collecting in Newfoundland. The trip is for the purpose of studying the circumpolar and nearctic molluscan fauna although collections of plants and insects will be made.

PUBLICATIONS RECEIVED

Notas y Adiciones a la Fauna Malacologica Habanera. Por C. G. Aguayo y M. L. Jaume (Mem. Soc. Poey, 8, No. 1. March, 1934). The name *Polygyra lingulata* (Fér.) is adopted to replace *P. paludosa* (Pfr.), preoccupied. *Vertigo torrei* is a new species of the *ovata* group. *Gyraulus santacruzensis* Germ., *G. filocinctus* P. & F., and several marine species, all new to Cuba, are reported from the environs of Havana.—H. A. P.

West African Achatinae related to Achatana balteata Rve. By J. Bequaert and W. J. Clench. American Mus. Novitates, No. 705. This group of closely allied granulous achatinas is critically reviewed and all of the known forms well figured. *A. rugosa chapini* is a new subspecies from Lukolele, Belgian Congo.

Two New Species of Fresh Water Pearly Mussels. By Wm. B. Marshall. Jour. Wash. Acad. Sci. 29, 79–81. *Castalioides laddi,* n. gen. et sp., is a Venezuelan Quaternary form. *Anodontites schadei* is from Paraguay.

Notes on the Fossil Land Shells from Bermuda in the collection of the Carnegie Museum. By Gordon M. Kutchka. Ann. Carnegie Mus. 22, No. 2–4, 1934. Eight species are described and figured, all from the Walsingham formation. Judging by the figures and dimensions given, the specimens referred to *Poecilozonites dalli, P. nelsoni callosus* and *P. blandi heilprini* do not appear to be correctly so named. From a careful examination, the type of *P. dalli* is a mature shell, in my opinion. The Walsingham formation has been considered Pleistocene by those who have studied it on the ground (see Sayles, "Bermuda during the Ice Age," Proc. Amer. Acad. Arts and Sci., 66, No. 11, 1931). Until some marine fossils are found to prove Pliocene age, the evidence that it is older than Pleistocene seems insufficient. Sayles has argued that it is synchronous with the Kansan glacial stage.—H. A. P.

Variation in Goniobasis virginica and Anculosa carinata under Natural Conditions. By Joshua L. Baily, Raymond

Pearl and Charles P. Winsor (Biologia Generalis, vol. 8, pp. 607–630, vol. 9, pp. 301–336, vol. 9–2, pp. 48–69; 5 plates). A statistical study of the shells from Gunpowder River, Maryland, is accompanied by detailed ecological data and an attempt is made towards their correlation. Erosion of the shell is accomplished by particles of silt carried in suspension in the water. The size of the shell seems to be directly influenced by chlorine and food supply, and inversely by silt. The earlier whorls are more variable than the later ones (the opposite has often been considered true). The presence of unaccountable differencs and variabilities in several lots is noted, and the suggestion is made that these may be due to congenital factors. An enormous amount of painstaking labor is condensed into these three papers. —H. B. B.

The Habitats of Land Molluscs in Britain, by A. E. Boycott (The Jour. of Ecology 22, pp. 1–38, Feb., 1934). An excellent paper dealing with associations of land mollusks in particular types of environments. A large amount of scattered information is brought together in this paper and carefully elucidated by the author. A portion of the summary is quoted. "Our land mollusca do not form specific associations with one another or with other animals or plants. Competition is therefore an unimportant factor. Their occurrence within their geographical ranges are determined by the conditions of the environment, the most important factors being moisture and lime. We may distinguish groups which affect wet places, dry places and human settlements. The rest, about half the species, [total of 102 species] live in ill-defined 'woodland' habitats whose suitability varies in proportion to the shelter and lime they provide."—W. J. Clench.

Non-marine Mollusca from Dutch North New Guinea Including an Annotated List of the Species of Papuina. By Tera Van Benthem Jutting (1933, Nova Guinea, 17, Zoology, Livr. 1, pp. 71–150, 21 text figures). Notes and descriptions of several mollusks (3 new species and 2 new varieties) from the region of the Mamberamo River. A list of all the known species

of *Papuina* follows the main report. This last, in particular, is a very valuable and useful list, as it brings together in one report all of the *Papuina* known to occur in the Australasian region. A suggestion, however, would be to list all varieties and subspecies alphabetically along with the species and not under their particular species. In a long list, such names are hard to locate when submerged in the main list. A full bibliography accompanies this paper.—W. J. Clench.

A List of the Mollusks of the District of Columbia and Vicinity. By Horace G. Richards. (The American Midland Naturalist, vol. 15, No. 1, pp. 85–88, 1934). This list, the first since the one by C. Lehnert in 1885, enumerates about 140 species of land and freshwater mollusks from a region in Maryland and Virginia within a radius of 20 miles of the Capitol Building at Washington, D. C. The material on which the list is based is taken from Lehnert's list together with corrections and additions based on collections in the Academy of Natural Sciences of Philadelphia and in the National Museum in Washington. Such a list is sorely needed for the District of Columbia as well as for other places. In a sense this list is a little untimely since in going over the material in the National Museum a number of names were included from it that should not appear at all. This is due to the fact that no critical revision of collections from the District of Columbia now in the National Museum was made. For example, *Polygyra fraudulenta, P. exoleta* (*i.e., zaleta* Binn.), *P. stenotrema, P. monodon* and subspecies *aliciae, Mesomphix cupreus,* and *Discus patula* as well as some others do not occur in this region at all. Several other species are of doubtful occurrence here. The use of certain genera like *Anculosa* (wrongly applied to the species *carinata*) that have revised by recent workers is unfortunate. These errors are due to misidentifications or to unrevised names copied without verification from material in the National Museum.—A. F. Archer.

THE NAUTILUS

Vol. XLVIII October, 1934 No. 2

RESTORATION OF SHELL PARTS BY THE PAINTED SNAIL, POLYMITA PICTA BORN

BY E. A. ANDREWS

Observation of the shells of snails shows in some cases besides the regular fine lines suggesting lack of uniform growth, occasional grosser breaks in the uniformity of the surface suggesting the healing of broken parts or the restoration of lost parts of the shell.

That snails do actually restore broken parts and heal over breaks in their shells was first demonstrated by the experiments of Reamur in 1709 and later by those of many zoologists from 1870 to 1911. From these experiments it appears that snails may restore the shell in two distinct ways; restoring lost parts at the rim of the shell by complete perfect shell joining on to the normal shell without serious differences in form, structure, or color; but making good insular loss of shell parts not at the rim of the shell by a sort of cicatrix material, hard and serviceable for the protection of the animal within, but very imperfect as compared to the former normal shell.

These two grades of perfection in shell restoration correspond to the two diverse regions of the mantle concerned in shell making; the young marginal part of the mantle being able to make all the outer layers of the shell with its colors and architecture while the older parts of the mantle far from the mantle margin can only add innermost layer to the normal shell or function after breaks to supply a sort of cement to mend the break but not to actually restore new shell in its totality.

Both color and architecture of the shell are due to the activities of the marginal part of the mantle which, as it were, is the die from which the shell is stamped out little by little at the edge as

growth goes on with a repetition of pattern comparable to that made by a printing roll for wallpaper or printed goods; repairs near the edge are actual new printings, but repairs far from the margin are but colorless patching.

The activities of the mantle near the margin are both secretory and muscular, while far from the free edge the mantle only secretes, apparently. The muscular actions of the mantle combined with its powers to make hardening lime shell as well as color in definite patterns is comparable to the like activities in that portion of the oviduct of birds in which the eggshell is formed, sculptured and painted, in the same characteristic way in active periods of the species and even of the individual, as may be seen in the domestic hen which may for some time lay eggs individually distinguishable from those of other members of the same flock.

In some gastropods the mantle is visibly colored somewhat in the pattern of the shell that it makes, the future materials being already assembled in the relative poitions they will occupy when incorporated into the shell. There would thus seem to be a point to point agreement between the mantle margin and its product, the shell.

However, the mantle margin is movable, not only to advance and recede, but apparently also to slip sidewise, since Techow[1] found that in the land snail *Helix pomatia* removal of both a piece of the shell and of the underlying mantle was followed by restoration of the shell sooner than by regrowth of the cut mantle, so that the mantle seemed to have glided to one side and part of it vicariously made an area of the shell that it normally would not have been concerned with.

Many of the experiments upon regeneration in gastropods have been performed upon shells that were rather uniform in color so that one part of the mantle margin had much the same function as adjacent portions. However, in snails with lengthwise color bands, the mantle margin makes sharply localized color effects upon a common ground, so that one locality of the mantle is responsible for a colored band and the adjacent part on either side makes only the common background. Such is notably the case

[1] Techow. Archiv Ent. Mech. 31: 278, 1910.

in the painted snail, *Polymita picta* Born, of Cuba, with its conspicuous lengthwise bands.

Some fifty-four immature snails of the western variety of this species, *P. picta venusta,* brought from Cuba by Mr. d'Alte Welch, each from one to one and a half centimeters in diameter, were used to test the ability of the mantle margin to restore shell of the proper kind to continue the normal pattern after removal of small pieces of the shell edge.

Of these shells 27 were dull white; 17 canary yellow, and 10 flushed with bright red. In general, there were three spiral bands, an upper and a lower dark band and a median band, rarely dark, but generally pale white. Thus the mantle edge was making dark above and below, in narrow regions, and a thin white region in the middle; with wide areas of white, yellow, or red between the three narrow regions.

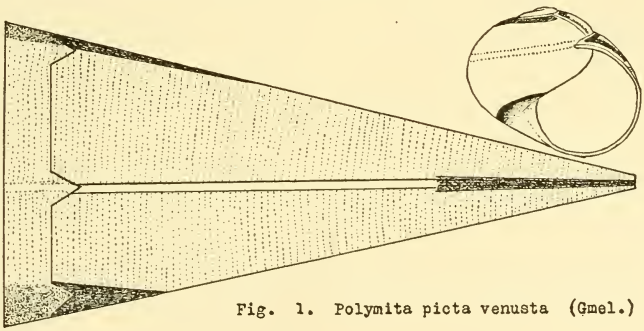


Fig. 1. Polymita picta venusta (Gmel.)

A rough diagram of the shell pattern may be made by representing the shell as unrolled and then projected as a triangle (see Fig. 1) in which the base represents the present mouth of the shell and the apex the long antecedent young shell now located at the apex of the shell. In youth the median band was dark, but later this gave place to a median band that is usually white, while the other two bands, both dark, arose subsequently, the latest and broadest being the ventral band.

In life the mantle margin of these snails is a velvet black zone at the border followed a little back from the edge by a golden yellow zone of white or red so that these two contrasting color zones on the mantle are very striking. In the black zone is the

mantle groove whose outer edge is somewhat lighter than the rest of the black zone and it is in this groove that the new shell is initiated.

The light colored sub-marginal zone may show some striking interruptions; thus when the shell has an equatorial band of light, or of dark, the light sub-marginal zone is marked by a sharp interruption of the same width as the shell band. The light zone is full of minute white reflecting particles and these are absent from the part of the zone immediately under the equatorial shell band, be it white or dark. Also the lighter submarginal zone may show dark patches above and below underlying the dark bands of the shell and in a shell with two parallel equatorial bands, two corresponding brown patches were seen on the mantle.

To see if the mantle would exactly restore the pattern when the shell was locally impaired, triangular areas of the shell, some 4 mm. wide and 2 deep, were cut from the shell with scissors, June 1st (the mantle being withdrawn by the snail so that it was not injured), in the three ends of bands as in Fig. 1 as well as in some of the background regions.

All the snails were kept in a glass jar of six liters capacity with top ventilation and various rather unsuccessful attempts at feeding, so that mortality was great, and in October only five were left alive. Other snails of the same species died as rapidly, though nothing was done to injure the shells.

However, many of the snails restored the regions of the shell that were removed. Some new shell with a bit of color in the right place was evident within a week in some snails, but others delayed so that at any time many were in various stages of restoration of injuries to the shells. Thirty-eight snails were living July 5 and eleven days later many had quite filled in the notches cut in the shells and some had extended the shell out beyond the old rim; but many never restored the shell injury before dying.

Restoration took place in the following stages: first a soft pellicle stretched as by surface tension across the deepest part of the triangular space, then extending gradually outward across more and more of the triangle. This soft pellicle stiffened and though at first at transparent as the evanescent pellicle that

anchors the shell to the substrate when the snail is long at rest, it became more opaque till when one to two millimeters advanced in width there was seen upon its under surface a little white, yellow or red pigment. After a long period this deposit became an opaque shell underlying the first formed periostracum.

As this colored opaque area increased, it was evident that it became the right color to replace what was removed; yellow joined onto yellow, white onto white, red onto red. But for a long time the new shell was thinner than the normal, less opaque, and lacking in perfection of finish, showing more evident lines of growth. Where the new joins the old, there is generally a faulting in the surface since the new is not built quite out to the level of the old surface. The first half millimeter or so of background shell sometimes remained lacking in opaqueness and in color, leaving a permanent scar. These experiments indicate that the mantle is able to reenact its old performances making for each area the proper color to continue the pattern laid down on the old shell.

Microscopic examination of the mantle margin after three days of regenerative activity showed a yellowish film emerging from the mantle groove full of shining dots; farther away from the groove the pellicle held scattered spherules and overlay nascent shell made up of compacted spherites aggregating into a layer.

This is in harmony with the accepted view that the periostracum is secreted out of the mantle groove and then reinforced from below by lime secretions that go to make up the deeper layer of the shell to be eventually reinforced by coloring matter and secretions from the parts of the mantle more remote from the mantle groove.

While in restoration of pieces of shell at the aperture the mantle acts as it did before, this repetition is local for each injured part and does not involve the mantle elsewhere; thus while in normal growth all the mantle margin is simultaneously active, in repair of local defects much of the mantle is inhibited while certain regions only are active. Only when the defects are built up to the former edge level does the entire front advance in normal addition to the entire edge of the shell, step by step with lines of growth showing rhythmic advance and stoppages.

The greatest advance of normal shell beyond the replaced triangular defects was four to five millimeters in four months, see Fig. 1, where the transverse lines indicate new shell out beyond the replaced triangular areas. This is preceded by the above change in coordination of adjacent parts of the mantle margin so that, apparently, the normal growth is repeated only locally just where needed to replace the lost shell; there only the mantle groove arouses to activity and there only the mantle secretes lime and pigment which seems to be in a colloidal matrix in which the pigment does not widely diffuse but remains properly placed to continue the normal color pattern of the shell. Restoration of the equatorial band advanced more rapidly than that of the upper and lower bands where dark coloring matter was slow to appear.

While the white equatorial band is directly continued in the new growths, there are cases in which it is faulted upward nearly one-half millimeter as if the mantle had been held contracted toward the apex of the shell. Also in a red shell the first restored part may be white, later on yellow and finally red; thus leaving a pale scar to show the imperfection of the first part restored.

When, by accident, one snail had its shell so completely broken that it was removed entirely, the snail lived on three days and crawled about, though gradually dwindling in size though in moist air. Here a new shell was started in form of wax-like secretion film, covering most of the body except the lungs and the left retractor muscle. This film started in the mantle groove, ran back over the velvety and white zones and thence over the body. Blister areas in this soft membrane gave effervescence with HCl. In water this pellicle peeled off the animal readily.

Such abortive shell making was seen by Techow on removing the shell from 51 *Helix pomatia,* all of which died, though one lingered 27 days without attaining any real shell.

In addition to real regeneration of marginal injuries to the shell, *Polymita picta* was found able to heal over insular areas (2 x 3 mm.) where the shell was removed on the first quarter of the last whorl by a delicate pellicle filled with minute granules crowding together to form an icy sheet. But death prevented

the perfection of this cicatrix as a firm cement. Yet in one case still living such a hole made at the end of the first whorl was in a few days covered over by a thin hard sheet completely healing the wound in the shell, though as yet too brittle to be of great protection.

ON THE SONORAN SIDE OF THE GULF

BY H. N. LOWE

(Concluded from Page 4)

One afternoon without a breath of wind, a heavy ground swell set in, and by night quite a blow from the southwest. By next day the rocks were swept clean of the olive green algae and the *Trivia* and *Crassispira* had to seek refuge under the rocks. The sand beach for miles was covered with acres of algae at high tide line.

The second afternoon after the storm, I was walking the beach about two miles from camp. Just beyond the acres of algae which contained only an occasional stranded *Aplysia californica,* oozing out its purple dye, there was a narrow strip of tide wash, not over fifty yards in extent, of fragments of ascidians, sponges, and corallines, in this I took about forty fine living specimens of a *Lamellaria* unknown to me; different colored animal from *L. diegensis* and higher spired shell than *L. stearnsi.* The mantle entirely covered the thin translucent shell and could only be removed by cutting across the back with a safety-razor blade.

As I expected, this was a chance of a lifetime, for next afternoon tide all had been either taken back into the sea or ground to fragments in the sand after the storm, for several miles this beach was almost unrecognizable; the rock ledges which had teemed with sea life were covered deep with sand and the intervening places where the sand had been were left bare showing the underlying fossiliferous rock.

One afternoon just as the tide was starting out, we heard a great commotion near the shore. It was a huge school of several thousand *corbina* (a game fish about three feet in length), pursuing a vast number of sardines, anchovies, &c. The pursuers drove their prey into our little cove, where they simply went

wild feeding on the small fish as they jumped out of the water in every direction. All the native population rushed down to the beach, simply walked into the water and caught with their hands in a few minutes all they could use for several days. Phil took a dozen fine fish in a short time. One of the dogs decided he wanted to be a fisherman too, so he swam out and brought in unaided seven large fish which he dragged up to tide line, shook and bit them until dead and then went back for more.

In half an hour the fun was all over, for the large fish headed out into the gulf once more to continue the pursuit of their prey. They kept within sight and sound of our camp for two days thereafter. Thousands of the small fish were stranded among the rocks by the rapidly falling tide. The corbina when freshly caught are one of the finest and most delicately flavored game fish in the world, but the fishermen claim do not ship well. The fish trucks with a load of ice usually arrive about sundown so the *pescaderos* could start out early next morning to locate a school of tortuava. While we were there, the fish brought in were all males or "macheros" as the native called them, and are somewhat smaller than the females and have a narrow head.

The fishing fleet usually returned in the late afternoon with their catch, which was quickly taken to the sand beach where heads were severed with one blow from a heavy ax; they were then drawn and washed clean ready to be weighed and packed in ice for their five hundred mile run to San Pedro, California, for general distribution.

An export duty is charged in kilograms by Mexico and an import in pounds by the U. S. A.; so they literally get them "going and coming" and with the high cost of transportation and the low selling price of fish the poor *pescaderos* fared rather badly. Some days the boats returned absolutely empty. However, one day shortly before the full moon, we watched them clean, weigh and pack in ice ten tons of fish on the beach by moonlight.

The sea birds at Punta Peñaseo swarmed in unnumbered thousands, pelicans, terns and sea gulls, the latter feeding all day on the fish heads and offal, seemingly never satisfied. The boobies and tropic birds were said to be nesting on Georges Island, a bird rock about twenty-five miles south of us, so we saw nothing of them at Punta Peñasco.

Although we had few cloudy days when we could see it raining on the Pinacates off to the north and on the San Pedro Martyrs in Lower California, not a drop fell in our camp. On three nights however there were heavy dews when everything would be dripping in the morning. I suppose those are times when all the little furry inhabitants of the desert have a real drink of water.

When our daily catch of small birds, pack rats, pocket mice, kangaroo rats, gophers, &c., was extra good, the natives came over in the afternoon to admire the "Pajaritos" and watch Mr. Huey prepare the skins of the "ratoneitos." I think Mr. Huey prepared about one hundred and eighty-six mammal skins, including one very beautiful skunk, and some ninety interesting and very beautiful land birds. No shore birds were taken. But when they saw the snake charmer draw a harmless gopher snake out of his bed one morning, that was the last straw. A snake was a snake to them whether a rattler or some nonpoisonous variety. At this time of the year the snakes and lizards were few and far between, although in hot weather there are myriads of them.

Besides fish and clams on our bill-of-fare we had one mess of quail, also one each of rabbit and wild duck and on one occasion we tried octopi (boiled and then fried), which proved a very savory dish, much favored in most foreign countries.

I had three good mornings of dredging, about two miles off shore in six to ten fathoms, mostly broken shell bottom. By some chance each time came on a Sunday morning. Either the tide was too low to be missed for shore work, the boats were all out fishing or the weather unfavorable. The dredgings netted some very excellent results in small material, several things I had before taken and may prove to be new species.

After three delightful and profitable weeks at Punto Peñasco, the last day proved to be the only really, disagreeable one. A gusty northwest wind blew all day, and sand was in everything. The wind gradually abated after sun down and by the aid of a glorious full moon we packed our camp outfit and started on our homeward trek at 7:30 in the evening.

The worst spots through the sand hills had been newly brushed,

(owing to an assessment of five pesos per truck to which we gladly contributed); two fish trucks which had been broken down in the road had been repaired and taken away; our load was over a thousand pounds lighter than when we came out. We let out half the air pressure in our tires and we had learned considerable about desert driving through soft sand. At any rate we started out with an absolutely cool motor and went through those sand hills aflying, mostly in second year, shifting only a few times into low gear.

After we were safely out of the sand hills, we made a camp in the open desert and slept till morning. The full moon made all the fantastic desert vegetation visible as well as the distant mountains. We drove all the following night and arrived in San Diego at three a. m. after a most successful and enjoyable expedition.

LAND AND FRESHWATER SHELLS FROM THE VICINITY OF YAKIMA, WASHINGTON

BY WALTER J. EYERDAM

I had intended to publish the following list several years ago but did not take time to do so before. During the winters of the years 1924, 1925 and 1927, in the months of February and March, I often made short excursions in and around Yakima in search of shells.

The best collecting was had below Yakima and nearly as far as Union Gap, especially in debris left by freshets and in the little ponds and swamps. Irrigation ditches and wet meadows were also prolific with some of the freshwater shells and *Succinea*. Several trips were made to the Rattlesnake Hills and other mountains but not a single specimen of mollusk was found except at the bases of some of the mountains. I believe that, after the intensive searches made on numerous occasions in the vicinity of Yakima, very few more species can be added to the list. The dry hills, which are mostly of disintegrated lava seem to be very poor in shells.

Practically all my collecting was done in the month of Febru-

ary during three years so other forms may possibly occur in other seasons. Although several species of slugs were common and several encountered were rare, none were collected.

All Pisidia were identified by Sterki. *Ferrissia* was identified by Walker and all the others by Pilsbry and Vanatta. Several corrections were afterwards made by Henderson and Vanatta on doubtful species.

Polygyra columbiana pilosa Henderson, about a dozen immature specimens in leaf mould, (1924); *P. devia* (Gould), doubtful, 8 immature specimens (1924); *P. mullani olneyae* Pilsbry, about a dozen specimens under cottonwood logs (1924); *P. ptychophora* (A. D. Brown), rare (1924).

Vertigo sp., 1 specimen in leaf mould (1924).

Haplotrema vancouverense (Lea), a few (1924, 5); *H. sportella sportella* (Gould), several (1924).

Megomphix hemphilli (W. G. Binney), in debris along Yakima River (1924); *Vitrina alaskana* Dall, in leaf mould, about 20 specimens, (1924, 5, 7); *Retinella binneyana* (Morse); *R. hammonis* (Ström); *Euconulus fulvus alaskensis* (Pilsbry), a few in leaf mould (1924–7); *Zonitoides arboreus* (Say), about 300 taken from a cottonwood log (1924).

Discus cronkhitei cronkhitei (Newcomb), not uncommon in leaf mould (1924–5); *Punctum conspectum conspectum* Bland, a few in leaf mould near Yakima River, 2 miles southeast of Yakima (1924).

Succinea gabbi Tryon (+ var. *gabbi* Pilsbry), same locality as *Punctum* (1924); *S. nuttaliana* Lea, 6 specimens in leaf mould (1924); *S. oregonensis* Lea, about 100 specimens in leaf mould (1924–25); *S. rusticana* Gould, 4 specimens in a dry pond (1924); *S. haydeni* Binney, doubtful, in a wet meadow near Selah, 2 miles west of Yakima (1927).

Lymnaea obrussa Say, not common, on sand bars in Yakima River (1924–25); *L. palustris nuttalliana* Lea, not common, in a pond below the county fair grounds (1927); *L. ferruginea* Haldeman, in ponds along Yakima River (1927); *L. proxima proxima* Lea, not common, in ditches in a meadow (1927).

Physa nuttallii Lea, common on water-plants in ponds and ditches (1924–7); *P. propinqua* Tryon (?), a few preceding.

Planorbis (*Menetus*) *opercularis planulatus* Cooper (+*P. callioglyptus* Vanatta), common in ponds along Yakima River (1924–7); *P.* (*Gyraulus*) *similaris* Baker (+*P. parvus* Say), in ponds along Yakima River (1924–7); *P.* (*Helisoma*) *trivolvis trivolvis* Say, a few in a ditch about 2 miles west of Yakima (1927).

Ferrissia oregonensis (Clessin), quite similar to *F. fragilis* (Tryon) and resembles *F. caurina* Copper. About 500 specimens taken from stones and sticks in running water near Union Gap (1925). *F. caurina* Cooper is generally found on lily-pads and other vegetation.

Valvata humeralis californica Pilsbry, common on *Myriophyllum* in ponds along Yakima River (1924–7); *V. virens* (Lea) (?), a few (1924).

Anodonta kennerlyi Lea, living in the mill pond at the Yakima sawmill (1924–7); *Gonidea angulata angulata* (Lea), a few broken valves, in Yakima River (1924–7); *Margaritifera margaritifera falcata* Gould, a few broken valves in Yakima River (1924).

Musculium engbergi Sterki (Mss.), in ponds in Yakima River near Union Gap (1925); *M. ryckholti raymondi* Cooper, a few with preceding.

Pisidium compressum Prime, on dead leaves in a small pond (1925); *P. variabile* Prime, mixed with preceding; *P. concinnulum* Stehki, same habitat; *P. subrotundatum* Sterki, in mud among weeds in a pond (1925); *P. randolphi* Roper, in sandy mud on bars in Yakima River (1925); *P. columbianum* Sterki, with preceding; *P. amoenum* Sterki (Mss.), on leaves in small ponds (1924–5), *P. politum* Sterki, with preceding; *P. punctatum* Sterki, 2 small specimens with two preceding.

Besides these collected personally, the following have been reported from near Yakima by Junius Henderson (Non-marine Mollusca of Oregon and Washington): *Sphaerium nobile* (Gould), *Oreohelix parma* (Hemphill), *Planorbis* (*Gyraulus*) *vermicularis vermicularis* Gould and *Physa sparsestriata* Tryon.

THE POLYGYRA TRIDENTATA COMPLEX

BY A. F. ARCHER

(Concluded from Page 26)

6. POLYGYRA FRAUDULENTA Pils. Pl. 1, fig. 6, Lafayette, Roanoke Co., Va. Diam. 16 mm.

Polygyra tridentata fraudulenta Pilsbry 1894, Proc. Acad. Nat. Sc. Phila., p. 20, pl. 1, fig. 6. (Morgan Co., W. Va., opposite Hancock, Maryland).

Triodopsis fallax (of authors), W. G. Binney 1885, Man. Am. Land Shells, p. 292, fig. 314.

Helix fallax, Tryon 1887, Man. of Conch. (2), 3, p. 143, pl. 29, figs. 82–84.

The shell is similar in size to *P. tridentata, but is less depressed. The umbilicus is wider and deeper. The aperture is dished or basin shaped, while that of tridentata is more level. The upper edge of the peristome as it leaves the body wall is bent downward at a considerable angle. The marginal tooth is situated low down on the peristome as in P. tridentata juxtidens, but is more inflected, and is usually broader than in tridentata. Quite narrow marginal teeth occasionally appear. The basal tooth is also more prominent than in tridentata, and the parietal tooth is also more prominent.* Whorls $4\frac{3}{4}$–$5\frac{3}{4}$. In size the species ranges from 12–20 mm. in diameter.

Its geographical range extends from Ontario throughout Michigan and most of the middle states east of the Mississippi river. It occurs in northern Kentucky and throughout the Appalachian Mountains, southward into Northern Georgia and Northern Alabama. Beyond those limits it has not been reported. The forms found in Ontario and Michigan are medium sized and rather dark horn colored. Medium sized to large horn colored forms occur throughout the southern half of Ohio, Illinois and Indiana. Medium sized specimens are found in Kentucky. Large and often dark specimens occur in West Virginia and the mountains of the western part of Virginia. The species is rare in North Carolina except in that area closest to the Tennessee line. The forms from this area are often under middle size. In Monroe County on the Tennessee side of the boundary line small and often depressed forms occur. In this region many specimens have the marginal tooth reduced in size. Large specimens are found in Knox County, Tennessee.

7. Polygyra fallax (Say). Pl. 1, fig. 7. Manassas, Prince William Co., Va. Diam. 13 mm.

Helix fallax Say 1825, Journ. Phila. Acad. 5, p. 119. (Philadelphia, Pa.?)

Triodopsis introferens Bland, W. G. Binney 1885, Man. Am. Land Shells, p. 292, fig. 315.

Helix introferens, Tryon 1887, Man. of Conch. (2), 3, p. 145, pl. 30, figs. 96–98.

Polygyra fallax, Pilsbry 1894, Proc. A. N. S. P., p. 21.

The shell is depressed-turbinate, and usually smaller than P. fraudulenta. It has a higher spire and usually more whorls (5¼–5¾), *the earlier ones being more closely crowded. The profile of the aperture is not basin shaped as in fraudulenta, but quite straight as in tridentata. The marginal tooth is much more deeply inflected than in fraudulenta, so that is bordered by the inner edge of the peristome. It may be either broad or narrow. The basal tooth is narrow and buttressed on the columellar side. The parietal tooth is less prominent, and resembles that of tridentata in appearance. The aperture is smaller and more constricted. The body whorl is not rounded as in fraudulenta but is somewhat angulate, a slight keel being present on the upper half.* The diameter of the shell varies from 10.5–18 mm.

The range of this species is chiefly confined to the Appalachian Mountains, and extends from the Schuylkill drainage southward through the Susquehanna, Potomac, James River drainage and into central North Carolina and coastal South Carolina. It is, however, absent in the Smoky Mountain district of North Carolina. Its Appalachian distribution is mostly on the western slope, Holston River drainage, etc. It has been found in Northern Georgia. The forms found in South-Eastern Pennsylvania and Maryland are generally medium sized or small. In Dorchester County, Maryland, unusually large forms have been found by R. W. Jackson, although by contrast unusually small specimens have also been collected in the same county. In the Potomac region medium sized individuals are characteristic. In the western half of Virginia a variety of forms occur. At Natural Bridge, Rockbridge County, Virginia, some of the largest sized specimens (20 mm. diam.) occur, while in Wythe County, Virginia, extremely diminute forms have been collected. Small or medium sized forms occur in central North Carolina,

as well as in the region between Spartanburg County and Williamsburg County, South Carolina. Medium sized specimens have been collected in northern Ohio, eastern Kentucky, and eastern Tennessee. On the whole, the variation in form is not great. This species occurs in great numbers only in very few localities.

8. Polygyra fallax goniosoma Pils. Pl. 1, fig. 8. Blountstown, Calhoun Co., Fla. Diam. 15 mm.

Polygyra fallax goniosoma Pilsbry 1912, Nautilus, 26, p. 80. (Blountstown, Florida).

The shell has a higher and more angulated periphery than in P. fallax. The axial ribs are more pronounced above the periphery than below, while in fallax the ribs are finer and more even in size throughout the body whorl. The umbilicus is more constricted. The aperture is more constricted, while the marginal tooth is more deeply inflected. The whorls are also less convex. Whorls $5\frac{1}{2}$ as in *fallax*. Although it has been suggested that this form may be related to *P. vannostrandi,* its dull surface, its fewer and more rapidly increasing whorls are rather more characteristic of *P. fallax,* and to that species it should be referred.

P. f. goniosoma has been reported from Calhoun County in northwestern Florida. It is remarkable that this form occurs at some distance from the lower limits of the distribution of *P. fallax.*

9. Polygyra vannostrandi (Bland). Pl. 1, fig. 9. Aiken, Aiken Co., So. Car. Diam. 115 mm.

Helix Van Nostrandi Bland 1875, Ann. of Lyc. of Nat. Hist. of N. Y., 11, p. 200. (Aiken, South Carolina).

Triodopsis Van Nostrandi Bland 1878, Terrestrial Air-Breathing Mollusks, 5, p. 312, fig. 206.

Helix Van Nostrandi, Tryon 1887, Man. of Conch. (2), 3, p. 145, pl. 30, fig. 99.

This species has a small shell, the largest specimens (about 12 mm. in diameter) approaching smaller specimens of *P. fallax* in size and appearance. *It differs in being higher spired with less rapidly increasing whorls. Whorls usually more numerous* ($5\frac{1}{2}$–$6\frac{1}{2}$). *Axial sculpture the same in both species, but in the case of vannostrandi the surface of the shell is shinier. The umbilicus is smaller and shallower, and the periphery of the body whorl is higher. The aperture is situated lower down and*

forms a smaller proportion of the height of the shell. The edge of the peristone is rounded off instead of being sharp. The parietal tooth is often prominent and the marginal tooth is nearer the base, but it is otherwise quite similar. The basal tooth is higher, sharper and more strongly buttressed on the columellar side.

This species ranges from coastal South Carolina through central Georgia, and just over the border into Alabama. Its range begins where that of *P. fallax* leaves off. There is comparatively little variation throughout its range.

10. Polygyra vannostrandi alabamensis Pils. Pl. 1, fig. 10. Wetumpka, Elmore Co., Ala. Diam. 10.5 mm.

Polygyra alabamensis Pilsbry 1902, Nautilus, 16, p. 30. (Auburn, Alabama).

Polygyra vannostrandi alabamensis, Walker 1928, Terrestial Shell-Bearing Moll., of Ala., Univ. Mich. Mus. Zool., Misc. Publ. no. 18, p. 24, fig. 28.

This variety is similar to *P. vannostrandi* in appearance. *The spire is lower while the whorls are more tightly coiled. The umbilicus is wider. The basal tooth is blunter and the marginal tooth is less inflected.*

This variety practically replaces *P. vannostrandi* in Alabama. It is widely distributed in the eastern half of the state.

11. Polygyra hopetonensis (Shutt.). Pl. 1, fig. 11. Hopeton Landing, Appling Co., Ga. Diam. 12 mm.

Helix hopetonensis Shuttleworth 1852, Bern. Mittheil, p. 198. (Hopeton, Georgia).

Helix Hopetonensis, Reeve 1852, Conch. Icon. 5 (Helix), fig. 709.

Triodopsis Hopetonensis, W. G. Binney 1885, Man. Am. Land Shells., p. 384, fig. 418.

Helix Hopetonensis, Tryon 1887, Man. of Conch, (2), 3, p. 144, pl. 30, figs. 94–95.

The shell varies in size (diameter 99–125 mm.). It is closest to *P. tridentata* in external appearance, but is shinier. In sculpture it is somewhat coarse, but in this respect *tridentata* occasionally exceeds it. *It contrasts with tridentata in having a narrower umbilicus. The tooth structure is quite different. The parietal lamella is long, curved and shallow. The marginal tooth is broad, rounded, slightly inflected, and situated halfway down the peristone. The basal tooth is sharp and buttressed on the parietal side.*

This species is coastal, and its range extends from Berkley, Virginia, into northern Florida. It ranges throughout the eastern coastal belt of North and South Carolina. It is remarkably uniform in color and size throughout its range, the largest specimens examined coming from St. Augustine, Florida.

12. POLYGYRA HOPETONENSIS CHARLESTONENSIS Maz. Pl. 1, fig. 12. St. Peter's Cemetery, Charleston, So. Car. Diam. 9.5 mm.

Polygyra hopetonensis charlestonensis, W. G. Mazyck 1913, Cat. of Moll. of South Carolina, p. 7. (Charleston, South Carolina).

This variety has several distinguishable peculiarities. It is exactly like *P. hopetonensis* in external appearance. In size it is often smaller. *The parietal lamella is shorter and smaller. The marginal tooth is smaller and uninflected. The basal tooth is small, smoother, undifferentiated, and without a buttress.*

This form so far has only been reported from Charleston, South Carolina, and its environs.

13. POLYGYRA HOPETONENSIS OBSOLETA Pils. Pl. 1, fig. 13. Newburn, Craven Co., No. Car. Diam. 12 mm.

Polygyra fallax obsoleta Pilsbry 1884, Nautilus, 7, p. 140.

Polygyra hopetonensis obsoleta, J. B. Henderson 1907, Nautilus, 21, p. 7.

The shell of this species is externally exactly like *P. hopetonensis.* Its distinguishing characteristic is the *lack of the marginal and basal teeth, whose places are taken by slight thickenings.* It has been reported from Craven and New Hanover Counties, North Carolina, and it may be limited to North Carolina.

NOTES ON THE NOMENCLATURE OF HAWAIIAN HELICINIDAE

BY HENRY A. PILSBRY and C. MONTAGUE COOKE, Jr.

In Dr. A. J. Wagner's classification of Helicinidae[1] the Hawaiian species known to him were referred to the three genera *Sturanya, Aphanoconia* and *Orobophana.* No genotypes of these new genera were designated. H. B. Baker in 1922

[1] Denkschr. K. Akad. Wissensch. Wien, Bd. 77, pp. 357–450. 1905.

(Proc. A.N.S.Phila., p. 43) named *Helicina laciniosa* Mighels as type of *Sturyana,* and *Helicina uberta* Gld. type of *Orobophana.*

Helicina laciniosa Migh. was described from Oahu and said to be 3/20 inch (about 3.8 mm.) in diameter. Wagner's *S. laciniosa* is a composite of two species: he includes references to Mighels and Gould but adds description and figures of an allied but larger species (diam. 6 mm.) from Kauai. Though placing it in *Sturanya,* he remarks that "Die Art zeigt wohl etwas abweichende Gestaltung des Deckels." *H. laciniosa* in several varieties is a widely spread shell in Oahu. It has an operculum which is not distinguishable from that of Wagner's genus *Aphanoconia* (of which *Helicina verecunda* Gld. was designated type by G. K. Gude, Fauna Brit. India, Moll., vol. 3, p. 366). But *Aphanoconia* is not a valid name on account of the earlier genus *Pleuropoma* Moellendorff (1893, Bericht. Senckenb. Nat. Ges., p. 140, type *Helicina dichroa* Mlldff.), which, as we have confirmed, has a similar operculum. Moreover, Wagner himself placed *H. dichroa* in his later genus *Aphanoconia,* ignoring *Pleuropoma.* It appears therefore that *Sturanya* and *Aphanoconia* fall as synonyms of *Pleuropoma.*

The Samoan and other Polynesian species which Wagner placed in *Sturanya* require a new name. We will call them Sturyanella, the type being *Helicina plicatilis* Mousson. This does not occur in Hawaii.

The species *Helicina uberta* Gld., *H. magdalinae* Anc. and *H. juddii* Pils. & Cooke are referable to the genus *Orobophana* Wagn. All other described Hawaiian helicinids are, we believe, to be referred to the genus *Pleuropoma.* Both of these Hawaiian genera are widely spread in the Pacific.

The genera discussed will therefore stand as follows:

Pleuropoma Mlldff., 1893, type *H. dichroa* Mlldff. Includes as synonyms: *Sturyana* Wagner, 1905, type *H. laciniosa* Migh., and *Aphanoconia* Wagner, 1905, type *H. verecunda* Gld.

Sturanyella Pils. & Cooke, n. n., type *H. plicatilis* Mouss. Includes *Sturanya* Wagner exclusive of its type-species. Not Hawaiian.

Orobophana Wagner, 1905, type *H. uberta* Gld.

TERRESTIAL AND FRESH WATER GASTROPODS OF THE ALLEGANY STATE PARK IN NEW YORK STATE[1]

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Since its gastropod fauna, particularly species of terrestrial habit, forms a relatively prominent part of the invertebrate fauna of the Allegany State Park in Cattaraugus County of western New York, and since the studies of the fauna and flora of the region of the Park made in connection with the Allegany School of Natural History are making the Park one of the better known natural history areas of the interior, it is desirable to record the species of gastropods that have been collected during a period of years. Our interest in the publication of the record is based also upon the need for furnishing additional basis for the studies of Natural History pursued in connection with the Allegany School of Natural History in the Park. The present list is not presumed to comprise the entire gastropod fauna of the region—perhaps no local list could justify such a presumption—but when our list is compared with those of other restricted localities and is checked against the general record of distribution, it may be supposed that the record is fairly inclusive.

The Park is a region of low mountains with relatively gentle wooded slopes to the beds of small brooks tributary to the loop of the Allegheny River that lies in New York State. The low mountains, up to 2300 feet, are of relatively uniform height, being merely the remains of the maturely dissected plain of the Allegheny Plateau. Glaciation extended almost to what are now the borders of the Park, but the Park itself is believed to be entirely without the glaciated territory. It may be remarked that all the terrestrial gastropods recorded here were taken from

[1] Contribution from the Zoological Laboratories of the Allegany School of Natural History, the University of North Carolina and Milwaukee-Downer College.

lands that never knew glaciation, although in some instances the places of collection were hardly a couple of miles from areas formerly occupied by glaciers.

The Park, about 100 square miles in extent, comprises comparatively little cultivated or open land. The forests are advanced second growth and are generally composed of maple, birch and beech with hemlock following in. In a few places there are well advanced hemlock forests or drier oak-hickory-chestnut associations. It is a region of relatively high precipitation for the state, with ground cover comparatively moist, supporting in quantity such low growing plants as ferns, club-mosses, Dalibarda, partridge berry and the like.

The waters of the Park are limited in variety, the gradients of the valleys being such as to prevent the formation of ponds or marshes. For unknown reasons the upland brooks are without the typical brook fauna of gastropods; *Goniobasis,* for example, is noticeably absent. In the first year of the School aquatic snails, other than ancylids, were found only in the lower part of Quaker Run. Since plants from other waters were introduced into the artificial lake constructed at the School on the upper part of Quaker Run, several species of pulmonate snails have appeared in great numbers in the lake, and a few in the run below. Operculate snails are still restricted, as far as we know, to the river and, perhaps, the lower reaches of its tributary waters. The only snail, other than the cap shells (ancylids) that we have reason to regard as native to the upper waters of Quaker Run, is the always rare *Menetus dilatus buchanensis* (Lea), of which only a single example has been found.

The territory covered here lies directly north of McKean County in Pennsylvania, for which, as well as for the other counties of the state, Dr. Brooks has recently published a list of terrestrial gastropods. Since it is to be expected that the two lists would be closely similar it seems worth while to indicate existing differences which might possibly be eliminated by further collecting.

Twenty-four of the thirty-seven land snails listed by us occur in McKean county; twenty-three of these are noted by Dr. Brooks; the twenty-fourth is represented by *Retinella indentata,*

taken just over the state line, in McKean County, in 1928 by Mr. Aretas Saunders. As all remaining twelve of our list[2] occur in more distant parts of Pennsylvania it is probable that they are present in the intervening region. Three species and one subspecies reported from McKean County, but wanting in our records,[3] may be expected to appear in the Park area, although they have so far escaped observation.

As the size of snails varies considerably in different parts of the country we have added data concerning size as far as they have been observed for each species.

For aid in confirmation or correction of identifications we are indebted to Dr. Frank C. Baker (Lymnaeidae), Dr. H. B. Baker, Dr. E. G. Berry, Dr. Stanley Brooks, Dr. William J. Clench (Physidae), Dr. W. B. Marshall of the United States National Museum, Dr. Henry A. Pilsbry, and Dr. Bryant Walker.

HELICIDAE. *Polygyra tridentata* (Say). Common under leaves and near old logs; generally buried; avoids the light. G.D. 13½ mm., H. 7 mm. (Blacksnake Mountain). G.D. 15 mm., H. 8 mm. (Lookout Trail). *P. inflecta* (Say). Only one immature specimen recorded. Measurements of mature local forms were not available. *P. sayana* Pilsbry. Rare. G.D. 19½ mm., H. 12 mm. *P. albolabris* (Say). Not common: range seems to to be limited to the lower end of Quaker Run Valley. G.D. 28½ mm., H. 18 mm. *P. zaleta* (Binney). Common; on mountain slopes along the entire course of Quaker Run. It occurs in the same localities as *albolabris* but is more widely distributed. G.D. 29 mm., H. 21 mm. *P. dentifera* (Binney). Common on all mountain slopes bordering Quaker Run. G.D. 23¼ mm., H. 14 mm. *P. denotata* (Férussac). Mountain slopes bordering Quaker Run; moisture loving; not common. G.D. 19½ mm., H. 10 mm. *P. thyroidus* (Say). Not common; all specimens so far have been collected on slopes or lowlands bordering the lower end of Quaker Run; none have been found above an altitude of 1600 feet. G.D. 27 mm., H. 17 mm. *P. fraterna* (Say). Not common; on steep slopes above Coon Run and Holt's Run; most abundant in the latter locality. G.D. 10 mm., H. 6 mm.

HAPLOTREMATIDAE. *Haplotrema concavum* (Say). Common

[2] *Polygyra sayana, Polygyra inflecta, Zonitoides demissus, Paravitrea multidentata, Vitrina limpida, Euconulus chersinus, Deroceras agreste, Helicodiscus paralellus, Punctum minutissimum, Pallifera dorsalis, Gastrocopta pentodon, Carychium exile.*

[3] *Succinea avara, Retinella electrina,* and *Deroceras laeve,* besides the subspecies *Succinea avara major.*

under leaves and logs; rarely comes into the open. G.D. 16½ mm., H. 7½ mm.

Zonitidae. *Zonitoides intertextus* (Binney). Common in fairly deep woods; frequently found in the open on old stumps and logs. G.D. 15 mm., H. 10 mm. *Z. ligerus* (Say). Fairly common; under leaves and rotting logs; never in the open. Many young specimens were found associated with *Z. arboreus.* G.D. 15 mm., H. 10 mm. *Z. nitidus* (Müller). In brush heaps and on the ground along the muddy banks of the Allegheny River near Quaker Bridge, New York, and Bradford Junction, New York. G.D. 6 mm., H. 3 mm. *Z. arboreus* (Say). Generally distributed; among brush heaps and in rotting logs. G.D. 5 mm., H. 2½ mm. *Striatura exigua* (Stimpson). One empty shell taken from a mossy hummock on the outer margin of Chamberlain's Bog, a glaciated region. G.D. 2¼ mm., H. 1 mm. *S. milium* (Morse). Not common. Under drifts of leaves on the north side of large rocks, Allegany Rock City. G.D. 1½ mm., H. ½ mm. *S. ferrea* (Morse). Rare; in decaying logs. G.D. 2½ mm., H. 1½ mm. *Paravitrea multidentata* (Binney). Under old leaves around rotting logs; associated with *Z. arboreus.* G.D. 3 mm., H. 1½ mm. *Mesomphix inornatus* (Say). The most common of the larger mollusks in the park; usually hidden under leaves and logs. G.D. 14 mm., H. 6 mm. *Mesomphix cupreus* (Rafinesque). In the same places as *M. inornatus;* not so common. G.D. 25 mm., H. 12 mm. *Retinella indentata* (Say). Rare; our specimens were not fully grown. *Vitrina limpida* Gould. Taken but once; several individuals found under a board on the wet bank of the Allegheny River at Quaker Bridge, New York. G.D. 4 mm., H. 2¾ mm. *Euconulus chersinus* (Say.) In old logs and under leaves on hillsides; not common. G.D. 2½ mm., H. 2¼ mm.

Limacidae. *Deroceras agreste* (Linnaeus). Under stones and wood on river banks at Quaker Bridge and Bradford Junction. L. 1¼ in.

Endodontidae. *Anguispira alternata* (Say). Abundant; under leaves and old logs in woods. G.D. 19 mm., H. 10 mm. *Discus patulus* (Deshayes). Very abundant in decaying logs; associated with *Z. arboreus.* G.D. 9 mm., H. 3 mm. *D. cronkhitei anthonyi* (Pilsbry). Common in drifts of leaves, Allegany Rock City. G.D. 5½ mm., H. 2½ mm. *Helicodiscus parallelus* (Say). Fairly common in old logs in woods. G.D. 3 mm., H. 1 mm. *Punctum minutissimum* (Lea). Common; on dead leaves in open spaces in woods. G.D. 1 mm., H. ½ mm.

Philomycidae. *Philomycus carolinianus* (Bosc). Common on damp wood. Frequently in the open. L. 3 in. *Pallifera*

dorsalis (Binney). On old logs and wet boards on the bank of the Allegheny River at Bradford Junction. L. 1 in.

SUCCINEIDAE. *Succinea retusa* (Lea). Very abundant in low wet places, especially on plants along the Allegheny River. L. 15 mm., W. 8 mm. *S. ovalis* (Say). Fairly common in high, wet woods. L. 12¼ mm., W. 7½ mm. (Blacksnake Mountain). L. 11 mm., W. 6 mm. (Lookout Trail).

COCHLICOPIDAE. *Cochlicopa lubrica* (Müller). Rare; under leaves in high woods; six individuals found under a wet board on the river bank near Quaker Bridge. L. 7 mm., W. 2½ mm. *C. lubrica*, var. *morseana* (Doherty). Blacksnake Mountain. Not abundant. L. 7½ mm., W. 2½ mm.

PUPILLIDAE. *Gastrocopta pentodon* (Say). Rare; so far only empty shells have been found among drifts of dead leaves lying in open spaces on the wooded slopes of Quaker Run Valley. L. 1¾ mm., W. 1 mm. *V. bollesiana* Morse. One specimen. Dead leaves near deep moss, Allegany Rock City. G.D. ¾ mm., H. 1½ mm. *Columella edentula* (Draparnaud). Common on the backs of Christmas Fern and Twisted Stalk; generally distributed. L. 1¾ mm., W. 1 mm.

AURICULIDAE. *Carychium exile* H. C. Lea. Rare; only one record of a few specimens taken in one place near the upper part of Quaker Run. None available for measurement.

LYMNAEIDAE. *Pseudosuccinea columella* (Say). Back waters of Quaker Run at Red Salamander Hill. L. 8 mm., W. 4 mm. Quaker Lake (at School). Aug., 1930. L. 10 mm. *Fossaria modicella* (Say). Stilson's pond near Randolph, New York. L. 8 mm., W. 4½ mm.

PLANORBIDAE. *Helisoma anceps* (Mke). Records of young specimens only. G.D. 7 mm., H. 4.3 mm. *H. trivolvis* (Say). Abundant in lake at School. G.D. 19 mm., H. 9 mm. *Menetus exacuous* (Say). Common; muddy pools at Red Salamander Hill. G.D. 4 mm., H. 1 mm. *M. dilatatus buchanensis* (Lea). In the mud of a pool by Quaker Run opposite the mouth of Dry Brook. G.D. 4 mm., L.D. 3.3 mm., H. 1.5 mm. *Planorbula armigera* (Say). Sides' Pond, Randolph, New York. G.D. 6¾ mm., L.D. 5½ mm., H. 2½ mm.

ANCYLIDAE. *Ferrissia tarda* (Say). Common; Quaker Run, near the School. G.D. 4½ mm., L.D. 3 mm., H. 1¾ mm.

PHYSIDAE. *Physa sayii* (Tappan). Bayou, just off the Allegheny River, near Cold Spring. L. 24 mm., W. 13 mm. *P. sayii oneida* Baker. Two specimens. L. 8 mm. W. 4 mm. *P. heterostropha* (Say). Lake at School. Pools at the foot of Red Salamander Hill. L. 15 mm., W. 9 mm. *P. gyrina* (Say). Lake at School. L. 17 mm., W. 10 mm. *P. integra* Hald.

Allegheny River at Riverside Junction, New York. L. 9 mm., W. 6 mm. *Aplexa hypnorum glabra* DeKay. Pools near Quaker Run at the base of Elko Mountain. L. 15½ mm., W. 8 mm.

VIVIPARIDAE. *Viviparus contectoides* W. G. Binney. From the Allegheny River, just over the state line in Pennsylvania. L. 36 mm., W. 25 mm.

AMNICOLIDAE. *Somatogyrus integer* (Say). Only immature examples found but these were abundant. On stones in the Allegheny River at Bradford Junction.

JAMAICAN LAND SNAILS, 2

BY H. BURRINGTON BAKER

(Plate 2)

The first paper of this series appeared in the July number, pages 6 to 14, in which the symbols used are explained.

Choanopoma triplopoma new species. Figures 6, 12, 13.

Shell (fig. 12) nearest that of *C. fimbriatulum,* but white, usually more depressed and more scabrous; spiral ridgelets (13 visible on penult, 28 on last whorl) narrower and sharper as are also corrugations of relatively broader reflection of peristome; growth riblets fine, but expanded over spiral ridges into delicate, deciduous projections. Alt. (of type male) 12.6 mm., maj. diam. 121 (15.3 mm.), min. diam. 86 (10.8 mm), with 3 whorls remaining. Operculum (fig. 6) almost flat, with about 9 close narrow whorls (like in *fimbriatulum*) ; calcareous plate consisting of a basal lamella, a high, steeply inclined, inner marginal lamella and a subequal, upper ("reflected") lamella, which is inclined upwards to almost horizontal on penult whorls but is inclined downwards and even fused with basal one near rim of last whorl, and which is decorated on upper surface with very strong, oblique, growth riblets that are higher where they join inner lamella; greatest diam. 5.4 mm.

Type locality (ANSP. 139607) : NM2. The calcareous opercular plate in this species shows how that of *C. anomalum* may have arisen by the junction of the rows of cells that secrete the basal and upper lamellae.

C. (Tudorops) redfieldianum magnitesta new subspecies. Figures 8, 9, 14, 15.

Males (fig. 14) about as large as females of *redfieldianum;* shell with lower, more rounded, growth threads, which are less

undulated by vestigial spirals. Alt. (type female, fig. 15) 19.6 mm., maj. diam. 72 (14.2 mm.), min. diam. 57 (11.2 mm.), with 3¼ remaining whorls. Type locality (ANSP. 139608): WV.

C. (Colobostylus) negrilense new species. Figures 7, 16, 17.

Nearest *C. bronnii* (C.B.A.), but last whorl with much finer growth-threads (about 17 to a mm. and averaging 10 to each intervarical space), forming prominent, but more evenly rounded, intervarical crests, which are separated by a wider groove from suture; with umbilical, spiral ridges extending on to base and represented by very weak undulations of the growth-threads (especially varical ones) even on sides of last whorl; outer peristome usually more narrowly but more abruptly reflected; ground color light brownish-yellow to dark brown, with numerous, fine, broken, chestnut spirals (often limited to pre-varical spots) and with one solid band in the umbilicus and two others inside the aperture opposite its attachment. Alt. (type male, fig. 16) 12.4 mm., maj. diam. 81 (10.1 mm.), min. diam. 67 (8.3 mm.), with 3¼ remaining whorls.

Type locality (ANSP. 139609): WWC. *C. negrilense* has 2¼, almost smooth embryonic whorls (sutural count) and the next whorl develops high, widely spaced, growth riblets and obscure spirals (as in all Jamaican species of *Choanopoma*). The upper calcareous lamella of its operculum (fig. 7) is only as broad as the chondroid plate or the shell aperture (as usual in *Colobostylus* + *Tudorisca*).

Chondropoma (Parachondrella) sericinum retreatense new subspecies. Figure 18.

Shell like *sericinum,* but with 2 to 3 growth-threads (5 to mm. on last whorl) enlarged and sometimes fused to form irregularly spaced crests at suture; outer peristome with basal half columellar as well as palatal walls expanded into plane of aperture; last whorl with 10 spiral rows of chestnut dashes, one solid band in umbilicus and one inside parietal angle, all showing inside aperture and on peristome; neanic whorls with broad, purplish brown band beginning ½ whorl from apex and extending 2½ whorls. Alt. (type, probably male, fig. 18) 15.6 mm., maj. diam. 55 (8.6 mm.), min. diam. 44 (6.8 mm.), with 7½ whorls (entire). Operculum almost "chondropomoid," with thin calcareous plate almost covering chondroid; growth ribs absent except near beginning of last whorl. Type locality (ANSP. 139610): WWF.

Poteria varians campeachyi new species. Figures 5, 19 to 22.

Shell dwarfed, with epidermis strained rust-red like soil, with

olive tints; growth lines very fine, crossed on last whorl by irregular, spirally impressed lines (type) or with traces of *varians* wrinkles; very variable in shape; basal keel mediocre to indistinct, only demarcated on umbilical side. Alt. (type male, fig. 19) 12.1 mm., maj. diam. 121 (14.6 mm.), min. diam. 101 (12.2 mm.), with 5 whorls (sutural = about $4\frac{1}{2}$). Operculum (fig. 5) with 11 whorls, concave; upper calcareous lamella thin and fragile, usually incomplete on earlier but complete on last two whorls, almost met by turned-up chondroid plate around rim.

Type locality (ANSP. 139611): KCC, near Campeachy Gully, under leaves in ganap zone at base of hills. This coastal race is approached by specimens of *varians* from KHWb; it is also similar to *lacteofluviatilis* (Pils. & Br.), but is usually higher, smaller and with more vestigial *varians* wrinkles.

Fadyenia fadyeniana (C.B.A.), rock-faces [KHW; type seen (broken)]; *F. baquiéana* (Ch.), mainly rock-faces [VCMb, c, d, VF, VW1; compared to worn shells probably from Chitty, which have more than 10 major spirals; first lot intergrades with larger shells which agree with description (2–3 interstitial spirals near periphery) of f. *mitchelliana* (Ch.) and appr. (maj. diam. 2.8 mm.) f. *sutherlandiana* (Ch.)]; *F. alderiana* (Ch.), rock-bases [EJF, shells probably Chitty seen; ENF with specimens approaching *poeyana* (Ch.) except in size]; *F. lindsleyana* (C.B.A.), rock-bases [ML2; type (unique) has $4\frac{1}{8}$ post-embryonic whorls]; paedogenetoid subspecies *jayanum* (C.B.A.), rock-bases, incl. quite typical [MM2-fresh, 3c-young, KHW-slightly appr. next; type has $3\frac{5}{8}$ post-embryonic whorls with nucleus as in *lindsleyana*] and more *Metcalfeia*-like race [KF; looks like description of *newcombiana* (Ch.)]. *Fadyenia, Metcalfeia* and *Lindsleya* are combined into a single subgenus, although the first has a longer opercular process than the others (*Lindsleya* + *Metcalfeia*). In this expanded group, the shells are depressed to globose conoid, often with heavy spirals but without epidermal expansions, and cover themselves with calcareous deposit that tends to form two spiral cornices, which are most pronounced in the type species and correspond to its two subangular regions.

Stoastoma pisum C.B.A., under rocks, males smaller than females, including quite typical greenish race [MM3c, 4; Adams'

material seen], one bright orange shell [NM2a] and race intermediate between *pisum* and *livesayanum* Ch. [NMV; shells probably from Chitty seen].

Stoastomops tenuis (C.B.A.), rock-faces, males usually smaller [KC2].

Eutrochatella pulchella (Gray), rock-faces, males usually larger, incl. typical [KHS, KHW], form *grayana* (Pfr.) [KHW, NM2] and appr. *multicarinata* [ENF]; subsp. *scitula* (Wood), rock-faces [M, NMM, NMT, VCMd, VF, VW (but VWS more carinate), WV]; subsp. *cavearum* H.B.B., weak climber [NM2c, NMV]; subsp. *multicarinata* (C.B.A.), weak climber [EJ1–3]; subsp. *cathartensis* H.B.B., under rocks [EEJ]; *E. nobilis* (C.B.A.), rock-faces, males larger, incl. typical [WWC] and race *retreatensis* H.B.B. [WWF]; *E. tankervillii* (Gray), rock-faces, secretive, males usually larger, incl. typical [NMV] and small race [NM2c-dead]; *E.* (*Excavata*) *costata* (Swby.), low rock-faces, males usually larger [VCN, near coast].

Prosperina nitida Swby., incl. typical [MM2–4, MN, NM] and mainly race *planulata* C.B.A. [VW2]; *P. linguifera* Pfr., typical [WC1, WWF] and var. *pulchra* C.B.A. [WSF, WC1, WCC]; *P. bidentata* C.B.A. [EEJ, EJ1, 3]; *P. pisum* C.B.A. [VW2]; all these species aestivate under rocks but rapidly climb rock-faces during rains.

Diplopoma? (*Parachondrops*) *campbelli* (C.B.A.), weak rock-climber [WWF; lower parietal region of outer peristome usually cut by deep notches into 3 to 5 spatulate projections]; *D? avenum* (C.B.A.) + *fraterminor* (Pils. & Br.), mainly rock-bases [ML2, MM3, MN1-fresh, MN3a]; *D? shepardianum* (C.B.A.), weak to fair rock-climber, mainly in open [WV, VW2-fresh]. This puzzling little group has a calcareous plate like that in *Rhytidopoma;* it almost completely covers the chondroid whorl and develops high growth-ribs, united medially into a vertical lamella; its radula is of the simpler type like in *Adamsiella.*

Adamsiella (*Adamsiellops*) *ignilabre* (C.B.A.), mainly rock-bases [ML2, MM4, MN3; opercular lamella inclined very steeply upwards and then curving back to parallel convexly and cover ⅔ to ¾ of the chondroid whorl, otherwise unsupported and very fragile].

A. mirabilis (Wood) [VW2-fresh]; *A. irrorata* Gloyne [VCMb, VF; operculum with calcareous lamella almost as extensive as chondroid whorl but very steeply inclined so as to cover little of latter; shell peristome shortly duplex in fully mature shells;] *A. variabilis* (C.B.A.) [MM4, NM2b-fresh; opercular lamella consisting of a rather low vertical region and an inclined upper one, which may cover about half of chondroid whorl; subsp. *granosa* (C.B.A.), including intermediate race [NMM] and typical with f. *errans* (C.B.A.) [MN2, 3]; *A. grayana* (Pfr.) [KC2, KF, KHS, KHW; opercular lamella fairly heavy, steeply and extensively inclined, with narrow upper rim which almost parallels chondroid whorl (like in *Choanopoma hillianum*)]; *A. monstrosa* (C.B.A.), typical [ML1-fresh] and intergrading with f. *intermedia* (C.B.A.) [ML2; opercular lamella similar to that of *variabilis* but with vertical region lower and upper rim steeper and less extensive]; *A. miranda* (C.B.A.) approaching *pearmanaeana* (Ch.) [NM2, 3; type lot of *miranda* is not solute to shortly so; mine are shortly to very solute, either descendingly or tangentially (like in *jarvisi*); opercular lamella inclined very steeply and extensively, upper end in penult whorls with narrow internal rim (like in *Poteria corrugata*) which curves over into a slightly more extensive outer one in last quarter of ultimate whorl]. All these species are fair climbers on rock-faces; the males average considerably smaller than the females.

Choanopoma fimbriatulum (Swby.), weak climber on rocks [MM2–4, MN]; subsp. *docens* (C.B.A.) [NMV, VWS]; subsp. *albinonodatum* (C.B.A.) [VF, VW1, 2, WSF]; *C. triplopoma* H.B.B., rock-bases [NM2]; *C. scabriculum* (*?*) *amabile* (C.B.A.), rock-bases [WSF]; *C. hillianum aculeosum* (C.B.A.) with f. *leporilabre* (C.B.A.), rock-bases [ML1]; *C. lincina* (L.), fair climber on rocks and tree-trunks [KHW]; *C. pisum* (C.B.A), rock-bases and under [EEJ, EJ1, 3].

C. (*Jamaicia*) *anomalum* (C.B.A.), rock-bases [ML2; with shell-sculpture, animal and habits of *Choanopoma;* calcareous plate of its convex operculum single, considerably thickened (but not double) at its median but thinning down to chondroid plate at its lateral edge, with heavy, oblique ribs on its upper

surface, which combine into a weak, vertical lamella at their median ends; *C.* (*J.*) *moussonianum* (C.B.A.) has a similarly convex operculum but lateral edge of its calcareous plate is double, although the upper "reflected" and lower lamellae are cemented together throughout most of their width (not sectioned); *C. retrorsum* (C.B.A.), on the other hand, is so close to *C. lima blandianum* (C.B.A.), which is also from Clarendon, that I even doubt their specific separation.]

C. (*Tudorops*) *interruptum* (Lam.) [KC1-fresh and young, KCW-subfossil, last whorl with obscure spirals]; *C. banksianum* (Swby.), fair climber [MN4, MN1, 3]; *C. redfieldianum* (C.B.A.), fair climber [VW1, WC, WSF]; subsp. *magnitesta* H.B.B. [WV]; *C. yallahense* (C.B.A.), weak climber [EJF]. In this section of subg. *Colobostylus,* the operculum (figs. 8, 9) is more nearly circular, has more gradually increasing whorls and its upper calcareous lamella overlaps the chondroid plate and the inner peristome of the shell. The opercula of such species as *C. interruptum* and *C. lamellosum* almost intergrade with those of *C. pisum* and *C. retrorsum* (*Choanopoma* s. s.).

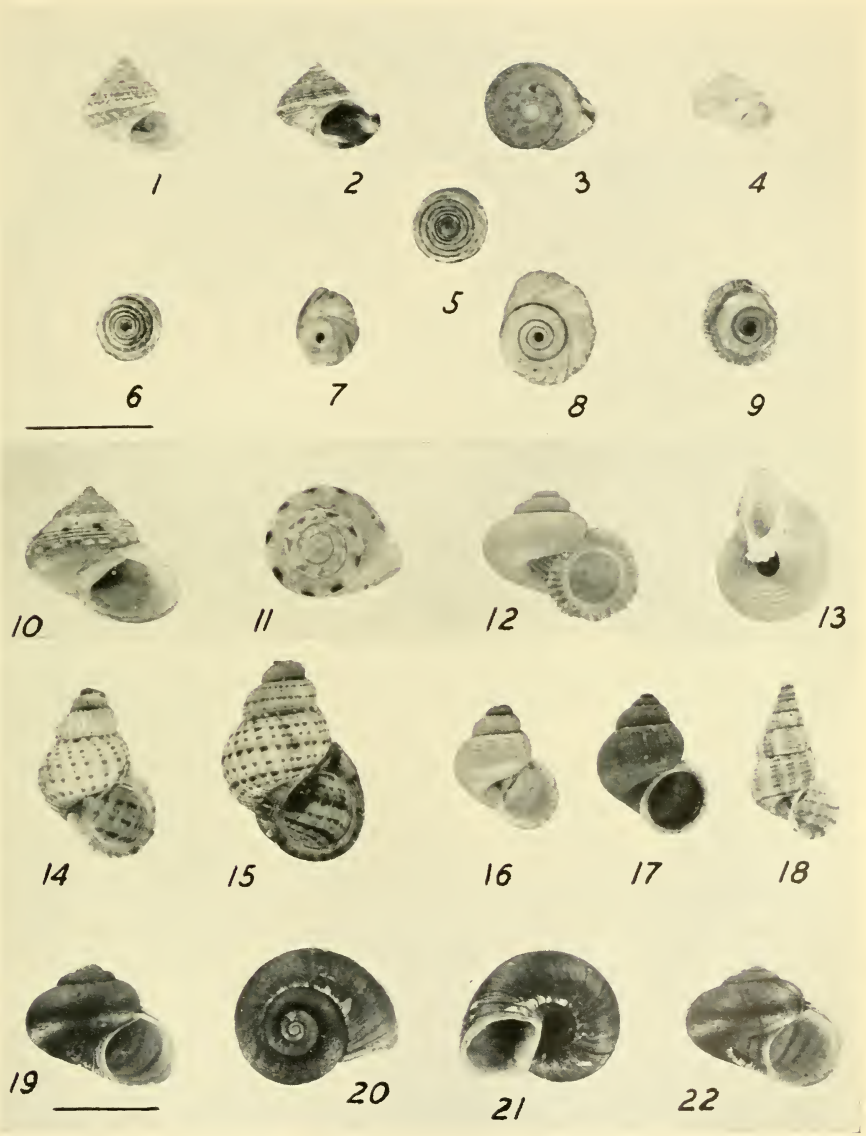
C. (*Colobostylus*) *negrilense* H.B.B., fair climber [WWC]; *C. bronnii* (C.B.A.), rock-faces and fair climber on trees, including f. *fuscolineatum* (C.B.A.) [VCM] and light form with typical color pattern [VF]; *C. album fuscum* (C.B.A.), but light colored, with prominent spiral malleation [EEC]; *C. chevalieri* (C.B.A.), typical with f. *album* (preoc.) and *virgatum* (C.B.A.), fair climber [VCN]; *C. solidum* (C.B.A.) (+*jayanum*), subarboreal [MM4, MN]; subsp. *rufilabre* (C.B.A.) [ML1, MM2, 3, MN1]; *C. thysanoraphe* (Swby.) [KHW-fresh]; *C. humphreyanum* (Pfr.), subarboreal [NMV, NMT-dead]. Males smaller than females in all species of *Choanopoma.*

Chondropoma (*Parachondria*) *fascia* (Wood), males and females extensively intergrading in size; last calcareous opercular whorl $\frac{2}{3}$ to $\frac{3}{4}$ width of chondroid; subsp. *proximum* (C.B.A.) [KF, EVL-fresh; opercular growth-ribs strong]; subsp. *augustae* (C.B.A.), subarboreal, including *testudineum* (C.B.A.), an intermediate race [ENF; peristome intergrading with both *fascia* and *augustae;* calcareous opercular plate very heavy, with high strong ribs], typical race [EEJ, EJ; calc. operc.

strong and fairly well ribbed in drier habitats, but weak and ribless on last whorl in rich forest, rarely ribless on penult whorl] and app. *nitens* (C.B.A.) [EEC; calc. operc. and ribs strong]. This variation in the calcareous operculum of the type species of *Parachondria* shows that, although a tendency towards rib development may be of systematic (although scarcely subfamily) value, the absence of the ribs and the reduction of the plate itself is of little significance; the usual retention of the ribs on the penult whorl indicates that their absence on the last whorl is not due to wear or erosion.

C. (*Parachondrella*) *fecundum* (C.B.A.), fair climber [KC1, 2; last calcareous whorl of operculum heavy, very coarsely ribbed, about 4/5 width of chondroid]; *C. muticum* (C.B.A.) [KCC-fresh]; *C. armatum* (C.B.A.), fair climber [KC2; last calc. whorl heavy, coarsely ribbed, leaving narrow margin of chondroid exposed]; *C. adamsi* (Pfr.), fair climber [VCN, VCMd-subfossil; last calc. operc. whorl heavy with high thin ribs, about $\frac{2}{3}$ width of chondroid]; *C. columna* (Wood), rock-bases [KHW; last calc. operc. whorl heavy with high thin distant ribs, about $\frac{3}{4}$ width of chondroid]; *C. aurora* (C.B.A.), fair climber [ECC, only found under short stretch of former sea-cliff near mouth of stream; last calc. operc. whorl very thin, $\frac{1}{2}$ to $\frac{3}{5}$ width of chondroid, with weak ribs, usually lacking on last $\frac{1}{3}$ to $\frac{1}{2}$ whorl; *C. sericinum retreatense* H.B.B., weak rock-climber [WWF]; *C. crenulosum* (C.B.A.), subarboreal [ML1, NMM-fresh; last calc. operc. whorl thin, only narrowly exposing chondroid, growth-wrinkled but not ribbed (like in *Chondropoma* s. s.); certainly not related to *Choanopoma album* (Swby.)!]. In all these species, the males average smaller than the females.

All the Jamaican species of *Poteria* bury themselves in humus, often near or under rocks, and seldom come to the surface, even during wet weather; the males and females intergrade extensively in size. Their opercula fall into three, none too distinct groups: (1) typical (approached on earlier whorls of other two), with more rapidly increasing whorls, and fairly simple, steeply upcurved lamella, which is weakly (typical) or strongly (*seminuda*) buttressed by distinct or confluent growth-ridges; (2) that of *varians,* with narrower whorls and incomplete to complete



1. Eutrochatella pulchella cavearum. 2, 3, E. p. cathartensis. 4. Lucidella adamsiana sublaevis. 5, 19–22. Poteria varians campeachyi. 6, 12, 13. Choanopoma triplopoma. 7, 16, 17. C. negrilense. 8, 9, 14, 15. C. redfieldianum magnitesta. 10, 11. Eutrochatella nobilis retreatensis. 18. Chondropoma sericinum retreatense.

upper lamella almost parallel to chondroid plate and (3) that of *corrugata,* with narrow whorls, on which the upright lamella tends to increase in height and is smooth on its lateral and striate on its median surfaces.

Plate 2. Scales represent 1 cm.; longer one for first 9 figs., shorter for figs. 10–23. Photographed by Alfred Zimmerman.

SOME DESERT HELICES OF THE GENUS MICRARIONTA

BY H. A. PILSBRY AND H. N. LOWE

MICRARIONTA ROWELLI MEXICANA, new subspecies.

San Francisco Mountains, 12 miles south of Sonoyta, State of Sonora, Mexico, collected by H. N. Lowe, Feb. 27, 1934.

The shell is light pinkish cinnamon on the spire and in an ill-defined band below the suture of the last whorl, which is elsewhere paler, nearly white. Shape nearly that of the type of *M. rowelli,* but a trifle more depressed. Apical sculpture as in *M. rowelli* and *M. desertorum;* subsequent whorls, up to a growth-rest line near the end of the penult whorl, with regularly arranged papillae, decidedly more distinct than in *M. hutsoni,* the last whorl smooth except for light growth ripples. Height 7.8 mm., diam. 14.8 mm.

In *M. rowelli* (type) the post-embryonic whorls show only the faintest traces of papillae on the antepenult whorl, none on later whorls. In *M. hutsoni* papillae do not extend to the penult whorl, and the umbilicus is a little wider.

All of these snails are very much alike, and in our opinion *M. hutsoni, desertorum* and the present form are best regarded as local races of one species, *M. rowelli,* which if this view is correct, is rather widely spread, and with an astonishingly discontinuous range.

These snails were taken about 12 miles south of Sonoyta in a range of granite mountains which lies just south of the trail to Punta Peñasco. They were found under loose rocks on the north slopes of the canyons nearest the road. A few were taken alive, fastened to the under sides of the rocks. There was a little protection by mesquite and other desert vegetation.

MICRARIONTA ROWELLI BAKERENSIS, new subspecies.

Limestone hill near Baker, San Bernardino Co., California, collected by H. N. Lowe, April 16, 1934.

The shell is pale ochraceous buff, with light pinkish cinnamon spire, a chestnut-brown band above the periphery, and a brownish band below the suture of the last whorl; often also some fine, oblique, protractive dusky lines in the peripheral and basal regions. In apical sculpture, deep suture and width of the spire it is like *M. rowelli.* Delicate papillae are to be seen on the penult whorl in fresh examples. Aperture about as in *M. rowelli,* but the parietal callus is quite thin, not thickened in old specimens as in that species. It is somewhat more solid than *M. rowelli,* more elevated, and with a narrower umbilicus.

Height 10.1 mm., diam. 17 mm., aperture 8.4 × 9.7 mm., umbilicus 2 mm. wide; 4½ whorls.

Height 9.5 mm., diam. 15.3 mm.

This shell is larger, more elevated and more narrowly umbilicate than *M. hutsoni amboiana* Willett, which is its nearest neighbor among the races of *M. rowelli.*

It was taken on the north slope of a small range of limestone hills just west of the highway, and about a half mile south of Baker. There was no protecting vegetation of any kind. The snails were about half way up the hill, just under a high cliff, and were mostly buried under a few inches of soil and small bits of rock. Several were found still fastened to the stones, but not a single live shell.

A NEW HELICOSTYLA FROM THE PHILIPPINE ISLANDS

BY THOMAS L. McGINTY

HELICOSTYLA LEOPARDUS MELADRYAS, new subspecies. (The dark wood nymph.)

Shape and surface as in *Helicostyla leopardus codenensis;* a band around columellar axis and the apical 1½ whorls black, the next whorl old rose; conspicuous on the penult, indistinct on the last whorl, which has a narrowly oblique-streaked hydrophanous tapestry, with some irregular, zigzag dark stripes. The

body whorl is dark brown or partially so with black lip edge, the aperture, and lip are blue (Dutch blue of Ridgway); columella pink. Holotype: length 47 mm., diameter 39 mm.

Habitats: Calangasan and Paniquihan, Baras, Catanduanes; both localities are in the southeastern end of the Island, The holotype from Calangasan, A.N.S.P. No. 139528, presented to The Academy of Natural Sciences, Philadelphia, Pa. Paratypes in the Museum of Comparative Zoology, Boston, Mass.; the private collection of Maxwell Smith, Lantana, Fla., and in the collection of Paul P. McGinty, Boynton Beach, Fla.

There are a few nondescript shells from both localities retaining some of the characteristics of the subspecies *meladryas* as: Lack of dark coloration, except around columellar axis but with pink apex; dark coloring present only on a portion of the body whorl, old rose being replaced with a white apical region. In some specimens the hydrophanous tapestry is completely lacking. The Paniquihan race is slightly smaller and shows more variation in color.

This striking and colorful shell was found on the leaves of abaca plants and on trees adjacent to streams where the tropical vegetation is extremely heavy.

NOTES AND NEWS

Exact Dates of THE NAUTILUS.—Volume 46 (2): pp. 37–72, pl. 3, was mailed Oct. 22, 1932; (3): 73–108, pls. 4–8 (+2), Jan. 25, 1933; (4): 109–144 (+8), pl. 9, Apr. 25, 1933. Volume 47 (1): 1–44, pls. 1–5, was mailed June 16, 1933; (2): 45–80, pls. 6 & 7, Nov. 1, 1933; (3): 81–116, pls. 8–11, Jan. 26, 1934; (4): 117–152 (+8), pls. 12–15, May 4, 1934.—H. B. B.

Liguus from a New Locality in Central Florida Everglades.—Of the *Liguus* in hammock no. CC–6, Collier County (collected by Geo. R. Waldeck), *L. crenatus lossmanicus* forms 55 per cent and *L. fasciatus* 45 per cent (var. *solis-occasus* 16 per cent, also var. *castaneozonatus* and hybrids). Most of the darker shells are *L. fasciatus* with pink tip and columella, which is opposite to the usual ratio. Generally, in hammocks where *L. crenatus* prevails, the dark shells belong to this species.—Mizpah Otto deBoe.

Monadenia hillebrandi has been one of the most difficult of the California land shells to get, on account of the back-breaking work required to find it. It can be easily taken however if the proper method is used. Within its range, which is limited apparently to Mariposa County at elevations above 3500 feet, locate large masses of broken granite, with moss along the bases of the piles or ledges. Go over the moss for mucus tracks, which, if plentiful, indicate good hunting. Then, go out at night about nine o'clock with a gasoline lantern and *hillebrandi* will be out crawling; the snails come out plentifully at night from deep among the granite blocks where they hide during the day. The resting places must be dry, for the snails come out all covered with dust. This method beats rolling rocks for them; in about 3 hours' hunting on two consecutive evenings recently, the haul was 250 adults and 26 immature, the largest of which I have ever heard.—Allyn G. Smith.

Note on Omogymna Martens.—In Woodring's (Carnegie Inst. Washington, Publ. 385, pt. 2: 226, 1928) admirable account of the Micocene Mollusca from Bowden, Jamaica, he employs *Omogymna* as a subgenus of *Oliva,* citing it as only known from the explanation of a plate in Dall's "Tertiary Fauna of Florida." As a matter of fact, however, the name was duly characterized by von Martens in 1897 (Arch. f. Naturg. Band I, Heft 2: 157) as a subgenus of *Oliva,* with *O. paxillus* Reeve as type; and Woodring's designation of *O. martensii* Dall is therefore overruled. Tryon (Man. Conch. vol. 5: 85) points out that *O. nitidula* Duclos is the same as *O. paxillus* Reeve, but is preoccupied by *nitidula* Dillwyn (not "Gmelin."). *O. ozodona* Duclos, which Tryon also includes in the synonymy, is certainly not *paxillus.* On the other hand, *O. sandwicensis* Pease (Pr. Zool. Soc. London 1860, p. 145) and *O. thomasi* Crosse (Jour. de Conch. 9: 173, pl. 6, f. 3, 4: 1861) are both the same as *paxillus* Rve. The types of all three are in the British Museum. *O. paxillus* seems to be a widely distributed but not very common Indo-Pacific species. In addition to published localities, I have recently seen it from Cocos and from Christmas Islands, both in the Indian Ocean.—J. R. Le B. Tomlin.

OLIVELLA MUTICA SAY.—This name has stood for so long that it seems almost iconoclastic to suggest that it must be superseded. Tryon's placing of *nitidula* Dillwyn as a variety of *mutica*, however, if correct, involved this. The most satisfactory reference given by Dillwyn is to Martini (vol. 2, pl. 50, f. 545–7) and of these f. 545 is certainly *mutica* while 546–7 are not so convincing. But, another author has anticipated Dillwyn. Link, in 1807 (Beschr. Nat. Sammlung Univ. Rostock, Abth. 2, p. 98) bases his *Porphyria minuta* on the above fig. 545 only, which I take to be certainly *O. mutica*. The earliest name for this species is therefore *Olivella minuta* (Link).—J. R. LE B. TOMLIN.

DISCUS SHIMEKII (PILS.) FROM THE BLACK HILLS, S. D.—This species was originally described (1890) as a loess fossil from near Iowa City, Iowa. Later, a living subspecies, *D. s. cockerelli* (Pils., 1898) was recognized from high altitudes in the Rocky Mountains, where it aestivates under superficial dead leaves and sticks, like most members of the dew fauna. [Incidentally, *Patula ruderata cronkhitei viridula* Ckll. (1890), although prior to either name, may be ignored as a practically nude quadrinomial.] September 15th, 1931, I found a living colony of specimens that more closely resemble the typical than they do the Rocky Mountain race, on the underside of moist boulders at the bottom of a large pile along the edge of the flats of Spearfish Creek, just above Savoy, Lawrence County, South Dakota, (altitude 4900 feet). Both the habitat and the elevation are very different from the usual haunts of *D. s. cockerelli*. *D. shimekii* appears to be the nearest United States relative of the European type of the genus. *D. cronkhitei anthonyi* (Pils.) is the commoner species in the Black Hills, where it was obtained from the slopes along Spearfish Creek (alt. 3700–5300) and above Deadwood (alt. 5000–5500). A characteristically eastern snail, *Strobilops labyrinthica* (Say), was found near the lower end of Spearfish canyon (alt. 4000), where it rubbed shoulders with *Oreohelix strigosa cooperi* (W. G. B.).—H. B. B.

THE FOURTH ANNUAL MEETING OF THE AMERICAN MALACOLOGICAL UNION

The Fourth Annual Meeting of The American Malacological Union was held in Stanford University on Monday, Tuesday, Wednesday and Thursday, June 25 to 28, and was a splendid testimony to the stability of the young organization as well as to the value of the movement. There were 32 registered. Although most of these were from California there were members in attendance from distant states, as Massachusetts, New York and Michigan. 36 papers were on the program which was opened by an address of welcome by Mrs. Ida S. Oldroyd. Her topic was "The History of the Stanford Collection." This was followed by the presidential address by Prof. Junius Henderson. The text of this was printed and distributed to members being on the timely subject of "Our Unstable Biological Classification and Literature." The annual dinner was attended by 36 and was the usual enjoyable affair.

At the business meeting an invitation from the Buffalo Museum of Science to hold the fifth annual meeting in Buffalo was accepted unanimously. An invitation from Captain Reed of St. Petersburg, Florida, that the 1936 meeting be held in Florida was read and favorably received.

A resolution recommending the publication of a revision of Josiah Keep's "West Coast Shells" by Joshua L. Baily, Jr., was adopted. It was also resolved to recommend and urge that the Academy of Natural Sciences of Philadelphia, if practicable, provide Dr. Pilsbry with assistance and publish a continuation of the "Manual of Conchology" to include the recent bivalve mollusks of the world.

The members of the Council elected for the year are as follows: Honorary President, Mrs. Ida S. Oldroyd; President, William J. Clench; Vice-president, Calvin Goodrich; Corresponding Secretary, Norman W. Lermond; Financial Secretary, Mrs. Imogene C. Robertson, Henry A. Pilsbry, Junius Henderson, Herbert N. Lowe.

A full report with list of members is published separately and may be had of the Financial Secretary, Mrs. Imogene C. Robertson, Buffalo Museum of Science, Buffalo, N. Y.

THE NAUTILUS

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THE FIRST PACIFIC CONCHOLOGIST

BY JOSHUA L. BAILY, Jr.

Who was the first man to gather shells from the Pacific coast of North America? This is not an easy question to answer. The first person to do anything is generally quickly forgotten by a populace willing to give credit to a later claimant. We do not know who was the first man to black his shoes, or to wear spectacles, or to build a steamboat.

Dr. Philip P. Carpenter states that the first conchologist to visit the Pacific coast was Dr. Johann Friedrich Eschscholtz, of the University of Dorpat, Esthonia, a specialist in the limpets, who visited San Francisco in 1822, and possibly also on another occasion a few years earlier. He states further that the first west coast shell to be named by the original collector was *Solen patula* Dixon, which was described in "A Narrative of a Voyage around the World" published in 1789. The first published figures of any west coast shells appeared in 1784, in "The Universal Conchologist," by Thomas Martyn, and Carpenter tells us these shells were collected by Captain James Cook, the famous navigator whose peregrinations so completely covered the Pacific ocean in the latter half of the eighteenth century.

Recently Mr. John Davidson, curator of the Junipero Serra Museum in Presidio Park, San Diego, has called my attention to a passage in the "History of California," by Zoeth Skinner Eldredge, that recounts conchological activity on the coast that antedates Cook and Martyn and Dixon and Eschscholtz by about a century. It now appears that the first collection of west coast shells was the work of Father Eusebio Francisco Kino, the Jesuit pathfinder who made history in the seventeenth century. In 1685 he was employed by the vice-regency of New Spain to survey the Gulf of California, and while doing so he landed at

some point on the west shore now unknown, and made his way overland to the ocean, where he picked up some shells that appeared to him to be quite unlike anything he had seen in the gulf.

In 1701 Father Kino was engaged in establishing missions in the Gila valley, at which time he noticed that the Cocomaricopa Indians were using wampum made of shells whose specific identity with those which he had obtained on the seashore eighteen years before he was quick to recognize. But how had they gotten into Arizona? The Cocomaricopa Indians were not boat builders, nor did they know anything about navigation. In fact, the Indians themselves told him that the shells had been brought in by land. This was the first intimation that Father Kino had that Lower California might be connected to the mainland, for on all contemporary maps it had been shown as an island, with what we now call the Gulf of California designated as the Straits of California. The early cartographers observed the Equatorial current flowing into the gulf, and bringing it a tropical climate, while the shore of the ocean in the same latitude was perceptibly colder, and they concluded that the current must have a means of egress at the upper end. It is said that in the mediaeval romance in which the name was first used, that California was a mythical island enjoying a tropical climate in a temperate ocean, and bearing that in mind the appropriateness of the name at once becomes obvious.

But to Father Kino the shells seemed more convincing than the current, and after sending specimens from both localities to the headquarters of his order in Mexico, where they created quite a sensation, he began that epoch-making march on foot from Tumacácori to the sea.

Travel in Lower California is difficult even today, but it is simple in comparison to what it must have been when Father Kino set out, and we cannot help admiring the audacious daring of this intrepid pioneer who eventually reached his goal, becoming the first white man to enter Lower California by land, establishing for all time its peninsular nature, and by means of his knowledge of conchology making for his name a place in history beside those of La Salle and Marquette.

It would be interesting if Father Kino's shells were preserved

somewhere in the archives of the Jesuit order, but unfortunately when the Jesuits were suppressed by Charles III their property was scattered, and most of it destroyed. Even the missions which Father Kino established, as well as those from which he set out, are today represented mostly by ruined adobe walls. We do not even know what the shells were, for his description—"beautiful blue shells"—is too meager to be considered anything but a *nomen nudum*. Of course, they had no scientific name, for the edition of Linnaeus's "Systema Naturae" from which all scientific nomenclature dates was still three quarters of a century in the future.

But if we cannot tell what species of shell it was that Father Kino collected we can at least make a pretty good guess. The most popular shell for wampum purposes among the Indians of Arizona today is *Olivella biplicata* Sowerby. Archaeologists tell us that this shell has been used in this way for centuries. And certainly no one who has ever seen a fresh specimen would deny its claim to be called beautiful. While its color ranges from white through various shades of yellow, purple, brown, and slate to almost black, the lower part of the columella is almost universally azure tinted, so that among unscientific people the shell is popularly known as the "blue point." Finally, its geographic distribution fits Father Kino's observations exactly, for it ranges southward to Magdalena Bay along the ocean shore of Lower California, and does not occur in the Gulf. We may therefore be justified in concluding that *Olivella biplicata* was probably the first west coast shell to draw the attention of the white man.

So far as I know, no attempt has ever been made to honor Father Kino's memory by naming a shell after him. In the past few years many expeditions have brought back material from the Gulf, and it is my hope that among the new species that will inevitably be recorded from the region when it becomes better known, one of them may be given the name of this explorer-geographer-missionary-naturalist of two and a half centuries ago.

San Diego, California
July 19th, 1934

THE RED SHELL MONEY OF WESTERN MELANESIA

BY WALTER J. EYERDAM

I have an 18-inch necklace of red shell money of extra fine quality. It was purchased at Rossell Island (St. Aignan's) at the source of its manufacture for one pound, which is the standard price throughout most of the islands of Western Melanesia for this particular kind and quality. The shell money is called sappy-sappy and consists of discs $\frac{1}{8}$ inch in diameter cut out of a species of *Spondylus*. The interior is white while the lip is a deep red. Only the upper valve is used, as the lower one is cemented fast to the rock upon which it grows. This *Spondylus* is found at a depth ranging from 5 to 10 fathoms.

This shell is very valuable to the natives of Papua and the Solomon Islands as a source of red and white shell money so highly esteemed as ornaments and heirlooms.

That this shell is quite rare I am certain, because in all of my intensive collecting of shells on more than a hundred beaches in the Solomons and New Guinea I found only four or five badly worn upper valves. The only localities where I found these few were near Kieta on Bougainville Island and on an islet near Tulagi Island. It was evident at first sight that these worn valves were cast up from deep water.

Sappy-sappy, or red and white shell money, is manufactured in only two places, and naturally at the best beds. One is on Rossell Island near Papua and the other in the Maravo lagoon near Malaita Island. There being so little of the red part on the shell, the rest being white, it is proportionately of higher value. The occurrence of this shell is very limited and restricted to only two or three good beds. The work of diving to a depth of 40 to 60 feet and the great amount of work expended in cutting out the tiny discs with primitive tools, and polishing them, is very laborious.

Polished sappy-sappy is worth twice as much as unpolished. Red money has four times the value of white money. The finest quality of clear color is selected for the kind to be polished.

This native money has a standard price and seems to hold its

own with British money. It generally represents the larger denominations of coin, and is chiefly used in purchasing wives, pigs, and paying fines and debts amongst the natives. It generally forms the principal hoarded wealth of a family and constitutes one of the chief values of heirlooms.

THE ECOLOGY OF THE LAND MOLLUSCA OF ASHEVILLE, NORTH CAROLINA

BY A. F. ARCHER

Although Asheville, North Carolina, is very accessible, it has not up to the present time been studied from the point of view of its mollusk fauna. In June 1934 a collecting trip was undertaken to Asheville for the purpose of studying the *Polygyrae* of the *Stenotrema* group, and along with this much data were obtained on the land mollusks in general. The places in which the collections were made consisted of the eastern part of the city of Asheville, Sunset Mountain and Rich Mountain (also known locally as Rich Knob). Sunset Mountain flanks the whole eastern side of Asheville and rises to an elevation slightly exceeding 3100 feet above sea-level. It is part of a horse-shoe shaped mountain mass, and is itself the western arm of the shoe, Rich Mountain forming the center of the loop, and rising to an altitude of 3535 feet, and Piney Mountain forming the eastern arm of the shoe. The shoe itself embraces a basin known as Chunn's Cove.

To understand the present day ecological conditions it is necessary to note the past history of the locality. Anthropoeic (human) factors have been the most active in producing the present conditions and in altering the ecology of the mollusks. Clearing and fires have produced certain perceptible changes, as is apparent if one studies for purposes of contrast the same faunal assemblage in less disturbed localities. These changes have been as great in the case of the mollusks as they have been in the case of the plants. The Asheville area has been repeatedly fired and lumbered. Fires here as elsewhere have been very detrimental to some species, and beneficial to others. However, it is not intended here to discuss the reasons for this, but simply to state as a fact

that which cannot be gainsaid by those who have had adequate field experience.

There are at Asheville two main vegetation zones. The first zone, zone A, extends from the settled portion of eastern Asheville and extends a short distance above the city to about the 2500 feet contour line. The second zone extends from the 2500 feet contour line to the top of Sunset and Rich mountains. There is no sharp line of demarcation between the two zones. The mollusk fauna will be described separately for each zone.

Zone A. The vegetation of this zone is of the *Kulturboden* type. It is here proposed to use an English equivalent for this well known German term, and refer to it as the culture area. The ground plants of the culture area of Asheville consist of a hodgepodge of weeds, vines, and brambles, as well as grasses on some of the level areas. As is so characteristic throughout the Blue Ridge physiographic province, honeysuckle (*Lonicera*) is the most conspicuous ground plant especially on sloping banks and stone walls. It takes hold readily on the soft red clay soil of this region. Brambles (*Rubus*) occur only in small patches where fires have created suitable conditions. Poison ivy (*Rhus toxicodendron*) occasionally occurs mixed with honeysuckle on sloping banks. Among the trees, the locust (*Robinia*) and the tree of heaven (*Ailanthus glandulosa*) are characteristic.

The outcropping rocks are azoic, and consist of gneisses. The red clay which forms the soil of this region is very soft, and gullies rapidly if there is no plant cover to hold it in check.

The mollusk fauna of this zone is poor in species, but rich in individuals. The species are as follows:

Agriolimax agrestis (L). This slug is common throughout the city and in the section at the foot of Sunset Mountain, but does not appear higher up. It has the *reticulata* pattern figured in J. W. Taylor, Monograph of the Mollusca of the British Isles, 1900–1907, p. 142, plate XV, fig. 3, but is distinctly yellower. It inhabits the edges of cement sidewalks, and during wet weather crawls on the lawns. It also lives in large numbers in honeysuckles both in exposed and shaded areas.

Retinella praecox H. B. Baker. A single dead specimen was found in honeysuckles.

Hawaiia minuscula (A. Binney). This snail occurs rarely in grass and under stones. It is also found in honeysuckles.

Polygyra altispira Pilsbry. The form occurring at Asheville differs from that occuring at higher altitudes in neighboring regions by being more depressed and having surface hairs that are longer and softer to the touch. In color the shell is a deeper brown, much like *Polygyra stenotrema* (Pfr.). This is the most common snail in the zone. It was found in great numbers living in honeysuckles along the edge of backyards and around outhouses. It was likewise very common in honeysuckles on the upper parts of sloping banks of a shaded ravine. Here the ground under the honeysuckle mat is paved with pieces of broken dishes, glass, fragments of flower pots and other kinds of less perishable rubbish, as well as small stones. During active spells it may be seen crawling on the stems of the honeysuckles. It is somewhat less common in honeysuckles around and on stone walls.

Polygyra rugeli (Shuttleworth). This species, somewhat less common than the previous species, lives in precisely the same habitats. However, it is more common than *P. altispira* on stone walls and at the bases of rock ledges. During inactive spells it secretes itself between or under stones, and in fact anywhere that it can crawl completely out of sight.

Polygyra albolabris major (A. Binney). One dead specimen of this species was found in some honeysuckles.

Zone B. The vegetation of this zone is mostly of the woodland type with the exception of a few cleared spots. The predominant plant association is the oak-hickory subclimax association. Intermingled with it are patches of oak-pine associations. The latter are especially favored on dry slopes by the frequent fires. The normal climax association of this area is the chestnut-chestnut-oak-yellow poplar association. The oak-hickory association has been favored by lumbering, but evidences of the climax association can be seen in the presence of numerous buckeyes (*Aesculus*) and yellow poplars (*Liriodendron tulipifera*), all young trees. Shrubs such as rhododendron and blueberries (*Vaccinium*) are present in patches. Ground plants consist of poison ivy, poison oak, Virginia creeper (*Psedera*), and lily of the valley

(*Convallaria majalis*). Brambles are not common in this zone except where there have been recent fires. Several cleared spots occur on or near the top of Sunset Mountain. They contain a growth of shrubs especially sumac, a fairly thick covering of grasses, clover (*Trifolium pratense*) and occasional strawberry patches. Some of the pastures have pines growing in them.

The soil on the higher levels is of a lighter color than that described for zone A. The rock outcrops are gneisses. In the woodland the ground is covered with leaf mould which is thin in the most recently fired spots. In the oak-pine patches the leaf mould is frequently acid and permeated with a white mould. The land snail fauna is as follows:

Haplotrema concavum (Say). Sunset Mountain. This species is rare. It lives under leaf mould.

Euconulus chersinus (Say). Sunset Mountain. This uncommon species lives under logs and in leaf mould in the oak-hickory woods near the top of the mountain.

Retinella praecox H. B. Baker. Sunset Mountain. This species is found occasionally in leaf mould and does not appear to be confined to any one section of the mountain.

Mesomphix perlaevis Pilsbry. Sunset Mountain; Rich mountain. A number of dead specimens were collected, but the living ones were few. The species is most usually found living on the high banks above the road. It lives in leaf mould and occasionally under rotten logs.

Gastrodonta interna (Say). Sunset Mountain. This species is apparently the most common and universally distributed zonitid in the locality. It is of great importance as an indicator of former fires, for it is favored by fires, and appears as one of the species of the fire succession group, is common under charred logs, and is as equally at home in oak-pine woods as it is in oak-hickory woods. It also lives in leaf mould and under uncharred logs. In pastures it may be found in considerable numbers under logs or rotten planks in company with *Zonitoides elliotti* and *Polygyra rugeli.*

Zonitoides suppressus (Say). Sunset Mountain. The local form is somewhat larger (diameter 6.7 mm.) than the form of the Piedmont of Pennsylvania (diameter 5.3 mm.), and its early

whorls are a brighter horn color than in the case of the latter form. It is almost entirely confined to the grassy areas around the sumac. It lives deep down in the grass completely hidden from view.

Zonitoides gularis (Say). Sunset Mountain; Rich mountain. This is another species that is favored by fires. It is most common in leaf mould often in acid areas, but avoids the neighborhood of pines. It is occasionally found under logs.

Zonitoides elliotti (Redfield). Sunset Mountain; Rich Mountain. This species is partial to pines. It is common under logs in pastures as well as under charred pine logs and rotten hardwood logs.

Zonitoides arboreus (Say). Sunset Mountain. This species is widely distributed, but nowhere common. It lives in leaf mould and under logs both in pine and hardwood areas.

Helicodiscus parallelus (Say). Sunset Mountain. A single specimen was found in some leaf mould in Chunn's Cove.

Gonyodiscus perspectivus (Say). Sunset Mountain. This species is nearly confined to Chunn's Cove. It is almost abundant under logs. It also lives in heavy leaf mould and around the bases of rocks. It is a small form (diameter 7.0 mm.), and is strongly angulated in the immature stages.

Philomycus caroliniensis (Bosc). Sunset Mountain. One adult was found crawling on a stump near the toll house.

Polygyra altispira Pilsbry. Sunset Mountain; Rich Mountain. This species is one of the more common species in zone B, but does not occupy the dominant position that it occupies in zone A. It is very unevenly distributed, being absent from the neighborhood of pines. Although it so commonly associated with hemlocks and balsams at higher altitudes, it seems to abhor pines. It is most common in the hardwood areas. It inhabits the treeless rocky banks above the road where it lives under leaf mould, but is scarcer in the woods above the banks. It is quite as common under charred hardwood logs as it is under any other kinds of longs, even unburned ones. Some of the logs under which it lives are partly overgrown with poison ivy. Occasionally, specimens occur in the more shady parts of the woods under dead leaves or logs.

Polygyra inflecta (Say). Sunset Mountain; Rich mountain. Apparently absent from zone A, it is widely distributed over the upper part of the mountain. It lives side by side with its close relative *P. rugeli* under logs and in leaf mould, but is not nearly as common as the latter. It is quite often present under charred logs and in dead leaves among rocks.

Polygyra rugeli (Shuttleworth). Sunset Mountain; Rich Mountain. This species is one of the most common and widely spread species in the zone. It is the dominant fire succession snail. It is common under charred logs in patches of pines. It is also common in the hardwoods under logs and in patches of pines. Its eggs are frequent in the leaf mould and under logs, and are laid in clutches of five or six. It is also frequent around rocks and on stone walls covered with honeysuckles bordering the road. Occasionally it may be found in pastures under logs.

Polygyra tridentata (Say). Sunset Mountain; Rich mountain. This species is most common on the Rich Mountain slope of Chunn's Cove where it lives under slabs of gneiss. It is a moderate sized form (diameter 16.5 mm.).

Polygyra thyroidus (Say). Sunset Mountain. This was found on the banks above the road where it is rare. It is a light colored form with a nearly closed umbilicus.

Polygyra albolabris major (A. Binney). Sunset Mountain. Due to fires this species is scarce. One fine living specimen was found under some sumac leaves.

Cochlicopa lubrica (Müller). Sunset Mountain. This species is rather uncommon. It lives in leaf mould and under pieces of bark and rotten logs. The local form does not seem to share the tendency to live in cleared territory that is so usual in members of the species in other parts of the world. This local form is referable to subspecies *appalachicola* Pils. However, *appalachicola* does not seem to be a true geographical race, for it crops up in Cheboygan County, Michigan, a long way out of its supposed range. Then too there are colonies in parts of Europe that are hard to distinguish from it.

Pupoides marginatus (Say). Sunset Mountain. One specimen was found in the grass in a clearing.

As a further word about fires and snail indicators of pyric

factors, taking *Polygyra* as the most dominant and characteristic genus in eastern North America, it will be seen that in undisturbed localities the large *Mesodon* type is quite as abundant and conspicuous as either the medium sized *Triodopsis* type (in the old sense) or the relatively small *Stenotrema*. When the balance is upset by some factors such as fires the latter two types are favored while the first is distinctly reduced in numbers. The truth of that is readily seen at Asheville where the large mesodons are reduced to a point where they barely maintain themselves.

JAMAICAN LAND SNAILS, 3

BY H. BURRINGTON BAKER

(Plate 3)

The first paper of this series appeared in the July number; the symbols used are explained on pages 7 to 9.

Geomelania minor densecostata new subspecies. Fig. 5.

With growth threads on later whorls finer and more closely crowded (51 on last); peristome quite evenly rounded or with marked baso-palatal point (type intermediate). Alt. (of type) 7.56 mm., diam. 3.17 mm., alt. last whorl 4.14 mm., alt. apert. 2.49 mm., diam. apert. 2.03 mm., with $5\frac{3}{4}$ whorls remaining (+ about $6\frac{1}{2}$). Type locality (ANSP. 163726): MN2, in a sinkhole.

G. (Scalatella) striosa pumila new subspecies. Fig. 6.

Smaller, with relatively more widely spaced growth threads (14 on penult, 16 on last whorl); with about 30 wavy spiral ridgelets becoming more obscure towards base on last whorl; baso-palatal point weak and rounded. Alt. (of type) 6.04 mm., diam. 1.57 mm., alt. last whorl 2.23 mm., alt. apert. 1.22 mm., diam. apert. .88 mm., with almost 7 whorls remaining. Type locality (ANSP. 163727): EEJb.

Veronicella leptothali new species. Figs. 2 to 4.

Notum (in alcohol) ochre with indistinct gray dots except in mid-dorsal light stripe, and with darker spots arranged to form an irregular, wide-meshed network. Hyponotum lighter than notum but darker than sole, with fine darker dots usually becoming more evident towards posterior end. Anus evident. Notal length (of type) 40.5 mm., width 44 (17.7 mm.), sole width 15

(6.1 mm.); female opening from anterior end 51 (20.6 mm.), from sole 29, querindex 3.4 (2.4 mm.); dimensions of another (WWC; fig. 4) 54.5, 37 (20.1), 9 (5.1); 53 (29.0), 27, 3.7 (2.3).

Spermatheca (fig. 2) with shorter stalk than in *V. laevis,* developing when fully mature, just below entrance of canalis junctor into its walls, a subspherical, thick-walled diverticulum. Verge (figs. 3, 4) small and slender (contracted in type) with relatively large, chalky-white glans. Dart papilla acuminate with slightly enlarged apex; glands consisting of 9 central, slender, simple tubules and of two larger ones, each of which immediately bifurcates and then rapidly and irregularly subdivides to form 9 and 11 (20 in all) stouter and longer tubules (3 times length of others and longer than entire animal; only bases shown in fig.) Penial retractor bifurcate near base of verge, arising as three strands at left of heart and over origin of right ocular muscle. Pedal nerves divergent abruptly near level of anterior heart margin.

Type locality: MN3. *V. leptothali* is smaller than *V. laevis,* has a relatively much slenderer penis and, when fully mature, develops a small sac near the base of the spermathecal stalk (very different from the large, thin-walled, vaginal bursa of *Leidyula*).

V. (Leidyula) kraussii trichroma new subspecies.

Dorsum with coarser papillae; anterior fourth chestnut-brown with white spots, especially towards mid-line, followed by broad, transverse white band (flesh-colored in alcohol) and posterior 3/5 inky black with a few brownish spots; tentacles brownish; hyponotum much as in *kraussii.* Immature, but with verge apparently similar to *kraussii.* Dimensions of type: 35.7, 50 (17.8), 19 (6.7); 52 (18.4), 23, 4.3 (1.5).

Type locality: VW2. This may be only a color form of *kraussii,* but is so very distinct that I suspect it to be a new species.

Allopeas, new subgenus of *Lamellaxis* Strebel & Pfeffer.

Type *Lamellaxis gracilis* (Hutton), to include species of *Lamellaxis* with elongate radular marginals which retain tricuspid fascies, with better developed accessory penial caecum than in *Leptopeas* and *Lamellaxis* s.s., with relatively simple straight columella, and without distinctly colored shell cuticle. Essentially *Opeas* s.s. of the Man. Conch., vol. 18; possibly a section of either *Tomopeas* or *Comoropeas* Pils. Anatomy of *Lamellaxis* fundamentally similar to that of *Pseudopeas,* while *Opeas* (type "*Stenogyra goodalli* Miller"), *Neosubulina* and *Ochrodermella* belong in the Ferussaciinae.

Varicella (Varicellaria) necrodes, new name for *Achatina procera* C. B. A.

(1849. Cont. Conch. 2: 24); not *Bulimus procerus* C.B.A. (1845, Proc. Boston Soc. Nat. Hist. 2: 13) = *V. (Sigmataxis) procera* (C.B.A.). Whitish even when fresh.

V. (Sigmataxis) paupercula tumens new subspecies. Fig. 7.

Opulent race with more whorls (attains 8¾ with alt. 13.8 mm.; MN2) and much vaguer varices (little darker than amber colored interstices); major growth lines usually weak and widely spaced on last 3 or 4 whorls. Alt. (of type) 12.68 mm., diam. 26 (3.27 mm.), alt. last wh. 43 (5.51 mm.), alt. apert. 25 (3.18 mm.), diam. apert. 52 (1.66 mm.); 8½ whorls.

Type locality (ANSP. 163822): MN3c. This variety differs from the paedogenetoid *V. paupercula* much like *perplexa* does from *V. laeviusculus.*

V. (S.) cylindrica new species. Fig. 9.

Shell thin, translucent; color amber, paler at apex, with light chestnut varices. Embryonic whorls rapidly increasing. Later whorls becoming flat-sided, with widely spaced, major growth-lines (sometimes more closely spaced on antepenult or preceding whorl), becoming very weak on last whorl, which usually shows spiral corrosion lines; suture lightly impressed. Long axis of aperture 30° to that of shell; peristome almost vertical but arcuate. Alt. (of type) 8.02 mm., diam. 26 (2.09 mm.), alt. last wh. 57 (4.60 mm.), alt. apert. 31 (2.47 mm.), diam. apert. 50 (1.24 mm.); 6¾ whorls, but attains 8 (EJ1, broken).

Type locality (ANSP. 163823): EJF. *V. cylindrica* is nearest *V. laeviusculus* and its affluent form *perplexa,* but has a larger apex.

V. (S.) subaquila new species. Fig. 8.

Shell small and slender with uniform, deeply impressed, well-spaced growth-lines (25 on last wh.); color dark golden with rather vague, broad, brownish varices. Whorls 7, fairly curvilinear, lightly shouldered below suture, which is deeply impressed. Long axis of aperture about 30° to that of shell; peristome 20°, weakly arcuate. Alt. (of type) 5.62 mm., diam. 24 (1.33 mm.), alt. last wh. 48 (2.72 mm.), alt. apert. 24 (1.37 mm.), diam. apert. 55 (.76 mm.); 7 whorls.

Type locality (ANSP. 163824): VWS. *V. subaquila* is nearest *V. parallela* (Pils.) but is darker, potentially smaller, with apical whorls relatively longer and with later ones more gradually lengthened.

Poteria jamaicensis (Wood, limited by Swby.) [KF, MM, MN, NM2; diam. 20.9 to 28.7 mm., intergrading with f. *novus-saltus* (Ch.) in MM4 and paedogenetoid, approaching *crassa* (C.B.A.) in exposed places]; *P. cycloata* (Ch.), which has weaker growth-striae on its earlier whorls than in paedogenetoid *jamaicensis,* including typical [WW], shells with umbilical carina and coarser wrinkles obsolescent [WC] and one *crassa*-like shell [VW1-fresh]; *P. densestigmata* (Ch.), paedogenetoid race [EE; diam. 20.7 to 25.4 mm., umbilical carina, pits and coarser sculpture often weaker; opercular lamella with almost smooth buttress, on last whorl widening at upper end and becoming rudely striate so as to finally form an upper lamella almost as broad as chondroid whorl]; *P. seminuda* (C.B.A.), quite typical [MN3b, NMM] and an extremely variable series [NM1, 2; usually with flatter operculum (one has failed to develop the heavy buttresses which leaves lamella similar to that in my *densestigmata*), shell depressed to globose, often with strongly sinuate peristome]; approaching subsp. *rubra* (Ch.) [NMV; usually depressed, entire surface diamond-cut or zigzag-wrinkled]; approaching subsp. *bairdiana* (Ch.) [NMT; globose-conic, diam. 24.5 mm.; opercular whorls rapidly increasing so that last is very broad; nearer *rudis-planusque* Ch., but that name violates the Code.]

P. notatior (Ch.), large race (=*corrugatus* Ch., not Swb.) [MN3; one reddish shell, more heavily wrinkled that *corrugatior* and with opercular lamella more "reflected" and more closely whorled than *jamaicensis*]; *P. varians* (C.B.A.), which is well named; subsp. *portlandensis* (Ch.), including typical race [EJ3; upper opercular lamella often irregularly eroded (acid humus) and incomplete], heavier and higher shells [EJ2, EJF] and paedogenetoid race [ENF in hills; diam. 19.7 to 21.5 mm., with *varians* operculum and intergrading shell-sculpture]; subsp. *varians* (C.B.A.), typical (*i.e.,* no. 6 of Adams, now chosen as type because his lot 5 contains no adult with an operculum), often with whitish bands and intergrading with smoother, reddish shells [KF-fresh, KHS-fresh, KHW]; subsp. (or race) *campeachyi* H.B.B. [KCC]; subsp. *corrugatior* (Ch.), including smoother shells approaching typical *varians* [MM3, MN3] but more with heavier and earlier wrinkles [ML, MN1, 3, MN3],

gemma (Ch.), a paedogenetoid race [ML2, on a dry hillside] and approaching subsp. *zigzag* (Ch.) but usually smoother below periphery [VCMb, d].

P. novae-spei (Ch.) [WC2, WWC; opercular lamella almost vertical, slightly spreading and scarcely "reflected," but beveled internally near its upper end so as to present an inclined to almost horizontal, coarsely striate surface, somewhat similar to that of *pallescens* (C.B.A.)]; *P. rupis-fontis* (Ch.), smallish stock [WWF; max. diam. 23.5 mm.; opercular lamella with striated internal bevel very steeply inclined]; *P. westmorelandensis* (Ch.) [WC1; one female, shell with close, wavy growth-ridges and almost no trace of coarser sculpture, but with operculum and umbilical carina like *corrugata*]; *P. corrugata* (Swby.; not of Pfr. or Ch.), quite exactly matching type figure [WSF; with opercular lamella more incurved than in *jugosa* and completely hiding striated inner surface]; subsp. *striosa* (Ch.), a very marked paedogenetoid race [VWS; with opercular lamella even more incurved]; subsp. *jugosa* (C.B.A.), including typical [VW2] and race *parva* (Ch.) [VW1].

P. (*Crocidopoma*) *suturalis* (Swby.) [NM1, 2, NMM; males and females not noticeably differing in size]; *P. dubiosa* (C.B.A.) [VCMb, d, VF, VWS; all the 23 animals examined are females!]. The epidermal fringes which characterize the operculum of *Crocidopoma* are usually worn away from fully mature individuals.

Geomelania jamaicensis Pfr. (+*affinis* C.B.A.), intergrading with f. *expansa* C.B.A. [WWF]; *G. gracilis* C.B.A. (+*peilei* Dean) [VW1, 2]; subsp. *media* C.B.A. [WSF]; subsp. *parva* C.B.A. [VWS; much more distinct than *media!*]; *G. hilliana* C.B.A. [VCMb; type not seen; mine look like *minor* but smaller and more slender, with point on lower palatal lip often lacking]; *G. minor* C.B.A., incl. quite typical [ML2, MM3c, MN3ab, NM2c, VW2; sometimes with lip like *vicina*] and smaller race [VW1]; subsp. *densecostata* H.B.B., incl. typical [MM4, MN1, 2, 3ac] and one smaller shell [NM1]; *G. vicina* C.B.A [MM2, 3bc, NM2a, also KHW? (broken subfossil); sometimes with lip like *minor* but with heavier ribs, as wide or wider than interspaces on last whorl and even more noticeably heavier but more widely spaced on

earlier whorls]; *G. pyramidata* C.B.A. [NMV? immature; type not seen]. All my species of *Geomelania* occur in rather open woods like on hill-tops, aestivate under quite clean rocks and are weak although prompt climbers on rock-faces.

G. (Scalatella) beardsleana (C.B.A.) [KHWa; very variable in size, with 22 to 32 ribs on last whorl]; *G. striosa* C.B.A. [EJF; 21 ribs on last whorl; type not seen); subsp. *pumila* H.B.B. [EEJb]; *G. elegans* C.B.A. [ENF]; *G. inornata* Ch. [?EEJ, 1.5 × 5 mm., 5½ wh., 35 threads on last whorl, with numerous fine spirals, lower palatal lip slightly produced; ?VWS, worn shell, 1.5 × 6 mm., 6 wh., with larger whorls and 40 low threads on last; type not seen, and Chitty's dimensions seem improbable]; *G. pygmaea* (C.B.A.), incl. quite typical [KF, ML2] and appr. *microglypta* Pils. & Br. [MN3ac].

G. (Chittia) sinuosa Ch. [VCMb].

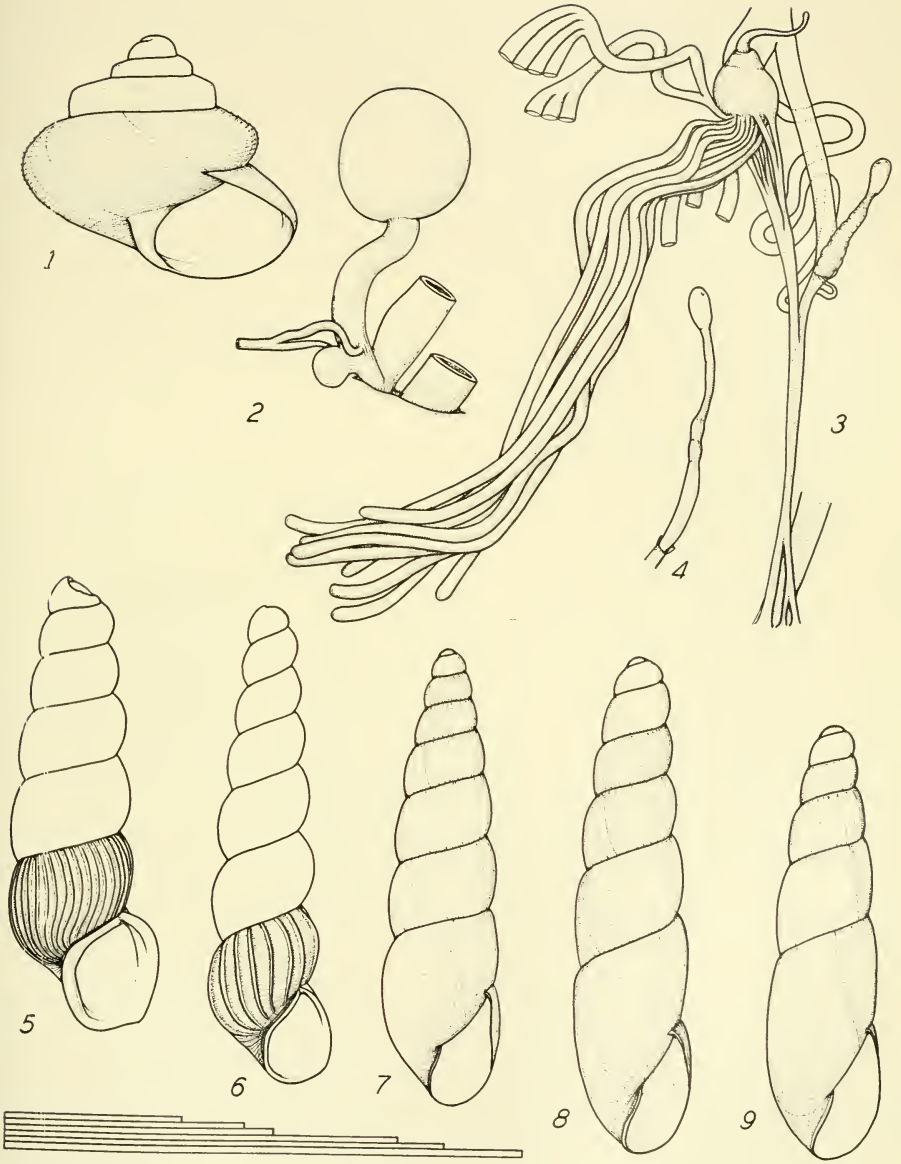
Veronicella laevis Blainv. [= *sloanii* (Cuv.)?], good nocturnal climber, often found in axils of banana leaves during daytime; the commonest species in culture [EEC (young, *schivelyae* color), EJ2, EJF (young, *schivelyae* color), KHS, MM1, 3 (incl. *schivelyae* young), MM4, MN3; attaining length of 85 mm. contracted, over 110 mm. when alive]; *V. leptothali* H.B.B., ground and under rocks in woods [KHW, MM4, MN2, 3, WWC, WWF–young].

V. (Leidyula) floridana (Leidy), ground near cultivation [MM4, MN3, VCM, VW1, WWC]; *V. kraussii* (Fér.) (+ *jamaicensis* Ckll.), ground and under rocks in woods, incl. typical [EEJ, EJ3, MM3, MN3, NMV, VCMb; usually without longitudinal stripes] and color-form (?) *trichroma* H.B.B. [VW2].

Carychium jamaicense Pils. [=*jardineanum* (Ch.)?], ground [EJF, KF, VCMb].

Pupisoma dioscoricola (C.B.A.), leaf-arboreal [EEC, MM2-fresh, 3, MN3-fresh, VCMb]; *Bothriopupa tenuidens* (C.B.A.), leaf-arboreal (EEC, EJ2, EJF].

Plate 3. Drawn with aid of camera lucida. Scales indicate 5 mm. and, from top to bottom, are for fig. 7, figs. 2–5, fig. 9, fig. 6, fig. 8, and fig. 1, respectively.



1. *Stoastomops adamsi.* 2–4. *Veronicella leptothali.* 5. *Geomelania minor densecostata.* 6. *G. striosa pumila.* 7. *Varicella paupercula tumens.* 8. *V. subaquila.* 9. *V. cylindrica.*

A FURTHER RECORD OF A CHITON (NUTTALLINA) WITH NINE VALVES

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I have been greatly interested to read Mr. Iredale's note on nine-valved chitons in the April *Nautilus*. Only the accident of my suddenly having to drop all scientific work for a time prevented the odd coincidence of my having in the hands of the editors another note on the same subject at the same time and perchance for publication in the same issue. The coincidence is past but the more enduring interest remains.

Miss Edna N. Wilson kindly submitted to me last year a beautiful 9-valved shell of our common southern Californian *Nuttallina*,[1] collected by herself at the Devil's Slide, La Jolla, California. It is a well-preserved dried shell in good condition, the ridge being considerably less eroded than is usual in specimens of this species. The interior is of the usual light slaty hue with the anterior portions of the valves more blackish. Valves v and vi are the largest, as indicated by the accompanying somewhat crude camera sketches. The dimensions of the specimen are, maximum longitude (very slightly curled) 33.4, maximum latitude 14.6, longitude shell only 32.6, width of tegmentum of valve v 11.4, altitude 5.7 mm.

The specimen seems not at all abnormal except for having an extra valve, and just *which* valve, if in fact it is possible to nominate any single one more than another for the distinction, can be called the interpolated one, I should not care to have to say. A photographic illustration would convey all this much better than the outlines can do and this I hope to find myself in a position to offer on a subsequent occasion.

[1] *N. scabra* (Reeve 1847), *non Chiton scaber* Blainville 1825; latterly referred by Pilsbry (1898) to *N. fluxa* (Carpenter 1864).

If Iredale's search of the literature is accepted as exhaustive, this is the fifth recorded example of a chiton with a supernumerary valve (hypermerism).

LITERATURE

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LONGEVITY OF MITRA IN CAPTIVITY

G. DALLAS HANNA AND LEO GEORGE HERTLEIN

On August 11, 1932, Templeton H. Crocker and party dredged five specimens of a large black *Mitra* in 6½–14 fathoms in Santa Maria Bay, Lower California. The dredging station was number D–24–R and the lot has since been given the number 27,594 (C.A.S.). Three of these specimens were kept alive in tanks on board the ship and were brought to the Steinhart Aquarium in San Francisco. Two of them died very soon thereafter but the third lived until June 6, 1934. During this time it was kept in a small salt water tank with other marine life and supplied with circulating unfiltered sea water from a local source. No attempt was made to control the temperature of the water and it seems rather remarkable that a subtropical species should be able to exist under these conditions for so long a period of time. The animal was evidently fully adult when received and did not increase in size.

The species was recently described as *Mitra zaca* by Messrs. Strong, Hanna and Hertlein (Proc. Calif. Acad. Sci. ser 4, vol. 21, no. 10, p. 120, pl. 5, fig. 10), and the holotype is number 6061 (C.A.S.). One specimen has been deposited in the collection of Mr. Herbert N. Lowe. The species is unquestionably closely related to *Mitra swainsonii* Reeve, (Conch. Icon. Vol. 2, *Mitra*, sp. 4, pl. 1, fig. 4, August, 1844), dredged in mud, seven fathoms,

by Cuming in "Monte Christi, west Colombia," That species, however, is olive-brown in color instead of black and the columella is said to have four plaits. *M. zaca* has a trace of a fifth. Reeve's figure shows fairly strong spiral lines on the shoulder and on the base whereas in *zaca* they are uniformly fine all over except near the columella where they are slightly stronger.

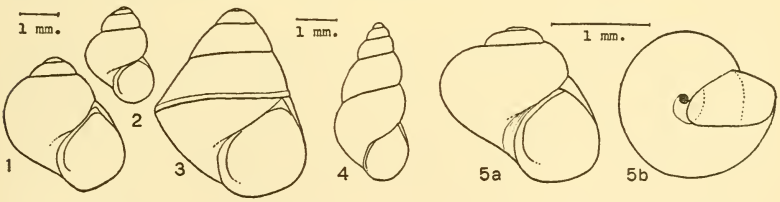
WESTERN AND SOUTHWESTERN AMNICOLIDAE AND A NEW HUMBOLDTIANA

BY H. A. PILSBRY

Potamopyrgus cheatumi, new species. Fig. 4.

The shell is imperforate, long-conic, brownish olive to grayish olive, the early whorls white by erosion of the surface. Surface rather dull, where unworn showing very weak lines of growth, usually scarcely visible. The whorls are strongly convex. The aperture is ovate, contained about three times in the length in large specimens, relatively larger in immature shells. The columella is slightly thickened, spreading a little in the umbilical region. Parietal callus thin, adnate. Length 3.75 mm., diam. 1.75 mm., aperture 1.3 mm.; 5½ whorls.

Phantom Lake, near Toyahvale, Reeves Co., Texas. Type 163888 ANSP., collected by Prof. E. P. Cheatum.



This Hydrobia-like species is referred to *Potamopyrgus* for the reason that it is viviparous, an example opened containing several young with shells about 0.4 mm. in diameter, of 1⅔ whorls. It is a far larger shell than *Paludestrina diaboli* P. & F., which moreover, is distinctly umbilicate. *Hydrobia seemanni* Ffld. is more similar, but it is distinct by the more slender shape and smaller mouth.

Cochliopa texana, new species. Figs. 5a, 5b.

The shell is minute, umbilicate, turbinate; olive to olive-brown, the first 1½ whorls white or nearly so. Whorls 3⅓, convex, the

last evenly rounded peripherally. Suture rather deeply impressed. Sculpture of very weak growth lines, not everywhere visible. Umbilicus narrow within, somewhat funnel-shaped in the last whorl, bounded by an angle which defines a lunate, excavated area behind the columellar lip. The aperture is oblique, broadly ovate, subangular posteriorly. Columellar margin adnate to the preceding whorl for only a short distance, thickened within, far less arcuate than the outer margin. Length 1.45 mm., diam. 1.5 mm.

Phantom Lake near Toyahvale, Reeves Co., Texas. Type 163887 ANSP., collected by Prof. E. P. Cheatum.

This is a smaller species than *C. riograndensis* P. & F., is less depressed, and has a far smaller umbilicus. It is nearly related to *C. rowelli* (Tryon) of Panamá, but that is a much larger shell, similar in conformation of the umbilicus.

It is likely that my *Fluminicola chihuahua* is really an aberrant *Cochliopa;* the umbilicus is like that of *C. texana.*

Fluminicola avernalis, new species. Fig. 1.

The shell is imperforate, somewhat rhombic in frontal outline, with short spire of about 4 whorls, the last rounded, the base impressed in the umbilical region. Aperture large, subrhombic, the parietal callus and the columella thick. Length 3.4 mm., diam. 3.1 mm., aperture 2.1 mm. long. A paratype is 4.25 mm. long.

Colorado Desert, California, with *Tryonia clathrata* Stimps., 40 specimens, most of them young or half grown. Type 27784 ANSP. These shells have been in the collection of the Academy about sixty or seventy years. They were labelled "Amnicola (Fluminicola?) n. sp.," with no more definite locality than "Colorado Desert." Two broken specimens of *Tryonia clathrata* were wedged in the apertures of the Fluminicolae. All of the shells are polished by blowing sand. They are presumably of Pleistocene age. I refrained from describing them before in the expectation that exactly localized examples would turn up, but it seems best to direct attention to them now, as some of the California conchologists may thereby be induced to look for the species.

Dr. R. E. C. Stearns (1901: Proc. U. S. N. Mus. vol. 24, p. 285) stated that he detected an example of *Fluminicola columbiana* among *P. protea* from the Colorado Desert. Probably what he

found was the species here described, as *F. columbiana* lives nearly 1000 miles further north.

Fluminicola avernalis carinifera, new subspecies. Fig. 3.

The imperforate, rhombic shell has about the shape of *Nitocris carinata* (Brug.). Spire short, obtuse, of fully 4 whorls, which are only very slightly convex; the last whorl nearly flat above, weakly convex below a strong peripheral keel, which weakens near the outer lip. The aperture is ovate, parietal callus thin, columella thick. Length 4.9 mm., diam. 4 mm., aperture 2.5 mm. long.

With the preceding. Type 164091 ANSP. Whether this is a distinct species or a carinate variation of the preceding cannot be decided until more material is turned up; but as only one was found among 40 *avernalis,* I am leaving it as a variety of that.

Hydrobia greggi, new species. Fig. 2.

The small, conic shell is umbilicate, with rather obtuse summit; dull green; composed of 4 whorls joined by a very deeply impressed suture. The surface is nearly smooth. Aperture broadly oval, narrower in the posterior part but not angular there. Peristome continuous but adnate above for a short distance, the outer margin thin; columella distinctly calloused; parietal margin thickened in old shells. Length 2.3 mm., diam. 1.8 mm., aperture 1.1 mm.

Cliff Creek canyon, a fork of Hoback canyon, about 29 miles south of Jackson, Wyoming, in the Snake River drainage. Type 163812 ANSP., collected by Dr. W. O. Gregg.

With the very convex whorls and general appearance of a Hydrobia, this snail has a distinctly thickened columella. The spire is more developed and the sutures deeper than in any Fluminicola. The small Fluminicolae, such as *F. turbiniformis,* have the columellar and parietal callus thicker, the spire much shorter. I do not know of any closely related species in the region.

Humboldtiana cheatumi, new species.

The globose shell is light yellow with blackish carob-brown bands, the upper and lower ones at least twice the width of the middle band. Very weak traces of granulation are visible in places on the spire, becoming obsolete or nearly so on the last half whorl; otherwise there are rather coarse wrinkles along lines of growth only. The peristome is somewhat expanded in the

basal curve, becoming broadly, triangularly reflected above, more than half concealing the umbilicus. Height 29 mm., diam. 33.5 mm.; 4 whorls.

From a small canyon near Ft. Davis, Davis Mountains, Texas. Type 164095 ANSP., collected by Prof. E. P. Cheatum. Paratypes in his collection.

Of the other species described from the Davis Mountains, *H. palmeri* Clench & Rehder is distinctly granulose throughout the last whorl except around the umbilicus. It is also much smaller, and the bands are subequal. In *H. ferrissiana* Pils. the last whorl is more depressed, the aperture more oblique, the middle band as wide as its fellows, and there is no granulation.

WEST AMERICAN SPECIES OF GONIOBASIS, WITH DESCRIPTIONS OF NEW FORMS

JUNIUS HENDERSON

Mrs. Henderson and I have collected *Goniobasis* at many localities in the Pacific States, and have spent a great deal of time in critically studying the large collections of them in the University of Colorado Museum and at Stanford University (especially the Hemphill and Hannibal collections), representing altogether about 200 localities. This study has led to the following conclusions:

1. Typical *Goniobasis silicula* (Gould) seems to be confined to western Washington, though material from Oregon and even California has been reported under that name by myself and others, through lumping with it several recognizable named forms. *G. s. bairdiana* Lea appears to be the prevailing form of this species in northwestern Oregon, usually easily distinguished. *G. s. rudens* Reeve is a recognizable variety, apparently represented by some of Hemphill's material from Olympia, at Stanford University.

2. *G. silicula shastaensis* Lea was originally described as having come from the Shasta and Scott Rivers, California, and Fort Umpqua, Oregon. I have seen no *Goniobasis* from the Scott River, and none from the Shasta River or the Klamath drainage that fits the description and figure of *shastaensis,* but we have

obtained material from Roseburg and other localities in the Umpqua drainage that conforms to both the description and the figure. I sent to the United States National Museum specimens from the Shasta, Klamath and Umpqua Rivers, for comparison with the types. They were submitted to Dr. Harald Rehder, who wrote, June 27, 1934: "The type of *Goniobasis shastaensis* Lea, together with twenty-two paratypes, bears the label: Scott and Shasta River, California, the specimens have been received from Dr. Trask. These specimens, as the photographs show, are different from the specimens that you sent us from the Shasta and Klamath Rivers, and are more like those from the Umpqua River. We had nothing in our collection like the specimens from the Shasta and Klamath Rivers. Most of the specimens from the type lot are indistinguishable from the Umpqua River material; they are, however, generally somewhat larger in size. Lea's specimens from Fort Umpqua are like your Umpqua River specimens, except that they have for the most part a more mahogany color. Whether Lea's type lot (from Scott and Shasta Rivers) really came from either or both of those rivers, or whether we are here dealing with a confusion of localities, I cannot tell."

Several years ago I had given to my Shasta River material the name *G. yrekaensis,* and prepared a description, which I include in this paper.

3. *G. plicifera* Lea occurs in northwestern Oregon and southwestern Washington. *G. oregonensis* Tryon and *bulimoides* Tryon intergrade interminably with typical *plicifera,* and were apparently abandoned by Tryon soon after he described them, yet many specimens may be easily assigned to one or the other, and the names may be worth retaining in a varietal sense.

4. *G. draytonii* Lea, described from Astoria, Oregon, and Walla Walla, Washington, and reported by Tryon from Sacramento Valley, California, we have tentatively identified from a number of northern California localities, but we have seen only two lots from the Columbia drainage that can possibly be referred to this species.

5. We have not recognized *G. bulbosa* (Gould), *newberryi* Lea nor *rubiginosa* Lea in the collections, unless, as has been sug-

gested, *circumlineata* from Sacramento Valley, is a synonym of one of them.

6. *G. acutifilosa* Stearns, *G. a. siskiyouensis* Pilsbry, and *G. occata* (Hinds), have been found only in California. *G. occata* from near Antioch, in the Hannibal and Hemphill collections at Stanford University, furnishes the most southerly record for the genus in the Pacific States, unless the uncertain type locality of *circumlineata* is the Mission San Antonio in Monterey County.

Goniobasis has been reported from "Vancouver Island (Forbes)? British Columbia in the streams west of the Cascades (Lord)." I have seen none from north of the southern portion of Puget Sound, in any of the collections examined, and have not found anyone else who has seen any. Which proves what?

Goniobasis hemphilli, new species. Plate 4, fig.1.

Shell of medium size, somewhat resembling *G. silicula* (Gould), but is decidedly flat-sided, evenly pyramidal, and divergence of the spire is greater; surface dull or very slightly shiny; color light to dark brown or horn; whorls 8 or 9, scarcely convex, usually slightly, slopingly, but sometimes sharply shouldered; suture well impressed, sometimes V-shaped; 5 to 7 upper whorls bear about 10 or 12 axial plicae, not so prominent as is usual in *G. silicula;* spiral sculpture variable, not pronounced, but visible on all whorls; in some examples the spirals on the upper whorls consist of a few impressed lines separating broader flat bands, in others, faint thread-like ridges, sometimes as many as 12 or 13, often crossed by faint sculpture paralleling the growth lines, giving the surface a slight beaded appearance; some specimens have a faint peripheral darker band, and two color bands sometimes show in the aperture, the stronger one at the base.

Holotype, largest specimen examined, from near Portland, Oregon, in the Hemphill collection in the University of Colorado Museum, No. 21167-a: Alt. 24.5 mm.; diam. 9 mm. Figured paratype, same collection, No. 21167-b: Alt. 22 mm.; diam. 8.5 mm. There are many topotypes in the same Museum, and in the Hemphill collection at Stanford University, nearly all practically perfect and quite uniform in size and color. This species is much less rugose than *silicula,* with which it has been confused, apical plications weaker, sides of whorls flatter and spiral sculpture different. From *G. bairdiana* Lea, occupying northwestern Ore-

gon, it differs in its lighter color, sculpture and much greater apical divergence. I have seen it only from the Portland locality.

Goniobasis hemphilli dallesensis, new subspecies. Plate 4, fig. 2.

Similar to *G. hemphilli* in form, size and sculpture, but greenish or brownish yellow, rather than brown, entirely without color band, surface slightly shiny, and most of the large lot slightly more slender. Holotype, from Mill creek, The Dalles, Oregon, University of Colorado Museum, 16016-a: Alt. 19 mm., a little broken from the tip; diam. 7 mm. Paratype, largest specimen examined, same collection, No. 16016-b: Alt. 22 m., apex missing, original altitude probably about 24 mm.; diam. 9 mm. Figured specimens, same collection, No. 16016-c. I have seen this only from the type locality, where it was abundant.

Goniobasis hemphilli maupinensis new species.

Shell much like *hemphilli* in shape and sculpture, but somewhat larger, more solid, uniformly much darker in color (dark olive brown, with a darker peripheral band), and the aperture is purple within, including the columella. In *hemphilli* and *dallesensis* the columella is white and the aperture white within. The surface of *hemphilli* is dull or but very slightly shiny, that of *dallesensis* more shiny and that of *maupinensis* still more so. The spiral sculpture is more irregular than in the other two forms, in many examples a few very sharp spiral striae standing out more prominently than the others, with flattened bands between, as in some specimens of *circumlineata.* The apex is missing from all specimens, but the earliest whorls present show the axial plicae as in *hemphilli.* Holotype, Univ. Colo. Museum. No. 17754-a: Alt. 23 mm. (original alt. probably about 28 mm.); diam. 9.5 mm. Paratype, largest specimen seen, No. 17754-b: Alt. 27 mm. (original alt. probably about 35 mm.); diam. 10 mm. Type and only locality, Deschutes River, Maupin, Oregon.

Goniobasis yrekaensis new species. Plate 4, figs. 3, 4.

Shell rather large, robust, less slender than *shastaensis* Lea; surface dull; color very light yellowish brown to darker brown, upper whorls usually brown, that color extending downward as a broad, dark band on some of the lower whorls; whorls 9 or 10, not very convex; suture well impressed; upper 4 or 5 whorls bear about 12 to 15 weak but regular axial plicae; lower whorls on most specimens covered with low, fine, rounded riblets, parallel with growth lines, giving to the surface a roughened appearance; 6 or 8 upper whorls spirally striate, the striae usually becoming more or less obsolete on the lower three whorls, but sometimes the

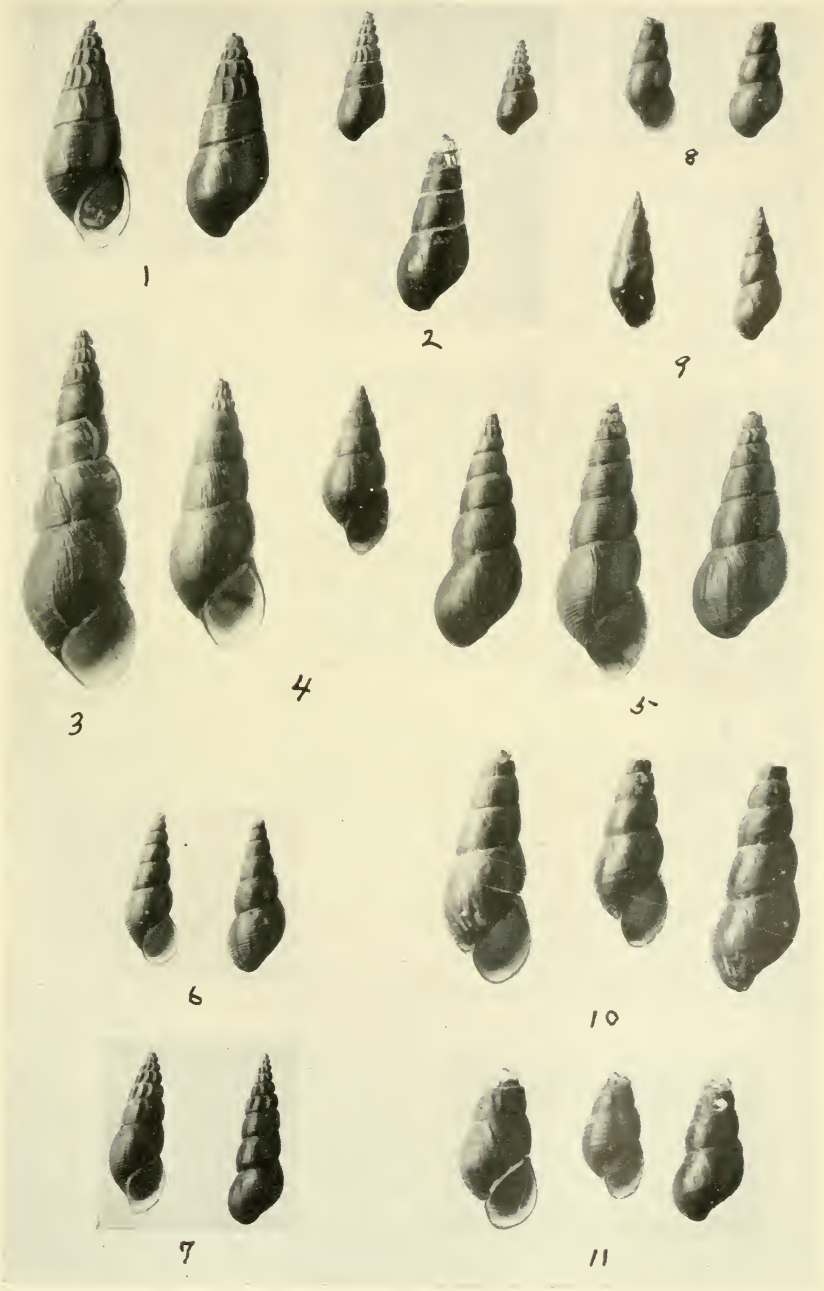
whole shell beautifully and finely striate; outer lip sinuous, bending a little forward toward the base, giving the shell a slightly beaked appearance; aperture about one-third the total length, white within, sometimes exhibiting the brown spiral band.

Holotype, Univ. Colo. Museum No. 17735-a: Alt. 39 mm.; diam. 11.5 mm.; aperture 11 mm. long, 8 mm. wide. Figured paratypes No. 17735-b. These are from a fine lot obtained by us in Shasta River, Calif., about 4 miles above the mouth, below Yreka. We found it also two miles east of Talent, at Grant's Pass in Rogue River, and in Deer Creek, southwest of Grant's Pass, all in Oregon, and received from Allyn G. Smith specimens obtained in Rogue River at Prospect, Ore. We obtained very fine specimens with greenish periostracum in Klamath River, 4 miles east of Klamath, and a slender form in Smith River, 9 miles northeast of Crescent City, both in California, and the West Fork of Illinois River, southwest of Grant's Pass, Oregon. Specimens from Klamath River, near Oak Flat Creek, Siskiyou Co., Calif. (Allyn G. Smith), are not quite typical. Greenish specimens, not quite mature, from Rogue River at Agnes, Ore., are in the Hannibal collection at Stanford University. Small specimens from a rivulet on Jelly Ferry road, below the Junction with Red Bluff-Manton road, California (Hannibal, Stanford University), resemble this species in color and general appearance, but the spiral sculpture and axial plicae are absent from the upper whorls.

Goniobasis yrekaensis obscura, new subspecies.

Closely related to *G. yrekaensis,* but shell uniformly smaller, more slender, and of very much darker color—dark brown or reddish brown, sometimes nearly black; sometimes with a broad, very dark band on the periphery, somewhat lighter above and below; usually two broad, dark red bands showing within the aperture. This well marked form we found in abundance in a creek two miles southwest of Wonder, Oregon, and have received from E. P. Chace a lot labelled "near Wonder, Ore.," perhaps the same creek. I have seen it from no other locality.

Holotype, University of Colorado Museum, No. 17724-a, 2 miles S.W. of Wonder: Alt. 20 mm. (apex missing, original alt. probably about 23 or 24 mm.); diam. 8 mm. Most specimens are



Junius Henderson: West American species of *Goniobasis*.

smaller, but appear to be mature. The peculiar axial striations on the lower whorls are not quite so well-developed as in typical *yrekaensis.*

(To be continued)

A BIOCHEMICAL METHOD FOR INTERNALLY CLEANING SMALL MOLLUSCAN SHELLS

BY DENIS L. FOX

Physiological Laboratories of the Scripps Institution of Oceanography of the University of California, La Jolla, California.

This communication is offered for the use of any interested persons who may be unfamiliar with the suggestion which follows. Conchologists and other shell fanciers are asked to bear with the writer if he is presenting to them a method with which they may have been long acquainted, for removing the natural occupant of a shell by enlisting the aid of a marine carnivore. The use of ants, fish, and other animals for cleaning skeletons preparatory to mounting has long been known.

In the past, I have effected the thorough internal cleaning of the shells of some of the smaller marine gastropods and lamellibranchs, for the aesthetic pleasure of others who wanted the finished shells, and in connection with my own studies of the digestive enzymes of marine invertebrates, by merely dropping the specimens upon the tentacles or oral disc of a sea anemone. Care must be taken to select hungry anemones, and to avoid offering them an excess, to ensure complete digestion of the meat. Crabs and other carnivores which might crush or otherwise damage the expelled shells or even wrest the food from the anemone before the latter can swallow it are excluded from the aquarium. The anemone seizes the mollusk and swallows it, discharging the cleaned, empty shell next day or perhaps earlier. Doubtless most species of anemone would perform the task satisfactorily. The species that I have in laboratory aquaria and have used is the common, large *Cribrina xanthogrammica,* which is so numerous and easily obtainable on the Pacific Coast.

Shells of rather delicate structure and color can evidently be cleaned in the above fashion. I have prepared, for example, such

shells as those of *Donax* and *Olivella* species by the anemone method; the discharged shells, after being rinsed off to remove traces of slime and gastrovascular fluid from inner and outer surfaces, still retained their natural beauty and lustrous glaze, were entirely divested of meat and therefore devoid of the usual residual and disagreeable odor. The valves of the lamellibranch remained fastened together by the undamaged dorsal hinge.

A fact which is particular scientific interest is that the complete digestion of the proteins of the mollusks' flesh took place in the presence of such a great excess of calcium carbonate which composes a large part of the shells, without visibly affecting the surfaces.

Such observations would lead one to conclude that the powerful extracellular protease or proteases within the gastrovascular cavity of this coelenterate are non-peptic in character, acting as they must in a slightly alkaline or at best, only very faintly acidic medium.

APLEXA HYPNORUM PILSBRYI N. SUBSP.

STANLEY T. BROOKS

Shell like *A. hypnorum,* but characterized by a long, strongly attenuate spire; the spire nearly one-half as long as the body whorl.

Length—	Greatest diameter—	Length of aperture—
10.8 mm.	4 mm.	5.7 mm. Type
10.3 mm.	3.8 mm.	5.5 mm. Paratype
9.7 mm.	3.8 mm.	5.8 mm. Paratype
10.8 mm.	4.2 mm. Paratype	

Type locality: Pond near White Rocks River, at Paradise Creek, White Rocks Canyon, Rocks, Uinta County, Utah, Twp. 2 south, Range 18 east, Salt Lake Meridan. *Collector:* Mr. E. R. Eller, Carnegie Museum Utah Expedition, 1933. *Type:* Carnegie Museum, Section of Recent Invertebrates, No. 62.26773. *Paratype:* Academy of Natural Sciences, Philadelphia, No. 164005.

I designate this subspecies *Aplexa hypnorum pilsbryi* in honor of Dr. H. A. Pilsbry, knowing, however, that this can in no manner compensate him for the generous expenditure of his aid, wisdom, and encouragement.

RECORD OF A CRYSTALLINE STYLE IN TWO FRESH WATER GASTROPODS

BY SAMUEL R. MAGRUDER
Department of Zoology, University of Cincinnati

As far as I can gather from a survey of the available literature a crystalline style does not seem to have been described as belonging to any member of the gastropod family Pleuroceridae. Some data concerning this interesting molluscan structure have been gathered during the course of a general anatomical study of some species of this family, a detailed account of which will be published later. However, it seems advisable to record these preliminary findings at the present time.

I have found a well formed crystalline style in *Pleurocera canaliculatum undulatum* (Say) and *Lithasia obovata* (Say) in connection with the intestinal tract. Although the style and associated structures have been observed in *Lithasia* and superficially appear very similar to that in *Pleurocera,* a detailed study has not been made in the case of the former. Therefore, the following description applies to *Pleurocera* only.

The style is about 1.5 mm. long and approximately 0.7 mm. thick in an animal of average size. Both ends are more or less rounded, the end toward the stomach being in a semi-liquid condition. The structure of the style agrees in general with that described for other forms. In a fresh style there is a distinct core, the "food core" of some writers, which is more opaque than the remainder of the style. The core is thickest at the posterior end and gradually narrows to a thin thread at the opposite end. The whole structure has a definite spiral arrangement which is seen most clearly in the core, the spiral being from left to right from the anterior to the posterior end. The consistency and color of the style vary greatly. In a supposedly healthy normal animal it is slightly flexible and varies from a clear transparent to a smoky bluish red. There is some evidence that temperature or food supply and possibly oxygen supply may have some effect on the style. In animals kept for some time at a temperature of 3° C. the style is from light to dark brown in color and the periphery is in a semi-liquid condition. A style has never been found in good condition in specimens which have

been preserved in alcohol or formalin or a mixture of the two. However, if a fresh style is removed and placed in a higher alcohol it coagulates almost immediately suggesting an albuminoid nature which has indeed been found to be the case by other workers on other animals. If a style is removed and placed in water, it completely dissolves in twenty minutes or less, the core being the first part to disappear.

The style-sac is of the type which is in restricted communication with the intestine through most of its length. However, it is really separated by the approximation of a major and minor typhlosole from the rest of the alimentary canal except for the large approximately round opening of the style-sac into the stomach through which the posterior end of the style projects to fit against the gastric shield. So in this important anatomical characteristic it is in agreement with *Crepidula, Paludestrina* and *Hypsobia.* In position, the style-sac is located directly anterior to the stomach and is about three-fourths as long. The lining epithelium is densely pigmented so that is appears irridescent when opened. The cilia characteristice of the remainder of the alimentary canal are most strongly developed in the style-sac.

The gastric shield which is usually associated with a crystalline style is found in the anterior part of the stomach on the right side opposite the style-sac opening. It is a thin, clear, very flexible sheet of material and fits firmly against the lining of the stomach. Its general shape and comparative size do not vary. The shape is roughly that of an oblong plate which has been twisted in a spiral fashion to form an incomplete tube toward the posterior end where the left side curves dorsally ending in a sharp edge which bears from two to seven acutely pointed teeth, their average number being six. The spines are continued on the outer wall of the shield as prominent ridges which fade out ventrally. The semi-liquid posterior end of the style fits against the gastric shield.

A more complete description of the style with illustrations will appear later in conjunction with an account of the complete anatomy of *Pleurocera canaliculatum undulatum* (Say). The writer wishes to thank Mr. Calvin Goodrich for identification of the animals used.

EDWARD GOSS HUMPHREY

Mr. Humphrey died at his home, 166 Highland Av., Somerville, Mass., on August 11, 1934, and was buried in Mt. Auburn. He had been in failing health for a number of years. He was born in St. Johnsbury, Vt., July 8, 1855. He attended the public schools of that place, the St. Johnsbury Academy, and graduated from Dartmouth College in 1877. From college he became associated with railroads in several capacities until he retired from active business. Coming to Somerville in 1892 he invested in real estate and made this city his home for the rest of his life.

He began collecting shells in 1900, choosing this group because, as he said, "It was a hobby that was not indulged in by many." He chanced to meet a person who had a box of shells which he was eager to sell and Mr. Humphrey purchased the box and contents without examination. This was the beginning of his study of conchology. From this little beginning his collection grew to contain thousands of beautiful and rare shells. In his work he was assisted by his devoted wife who shared in the interest and pleasure. His collection was purchased by an alumnus of Dartmouth College who presented it to his Alma Mater.

Mr. Humphrey did not possess many books on conchology; he depended largely on libraries and collections for identification of his specimens. He spent much time at the Boston Society of Natural History and the Museum of Comparative Zoölogy in Cambridge in comparing his shells. His connection with the Boston Malacological Club dates from the second meeting, March 14, 1910. From this meeting his deep interest in the Club continued until his death. He took part in the discussions, and was constant and punctual at the meetings. He was elected Secretary-Treasurer in 1916 and served for eight years. In 1926 the Club honored him with a Life Membership.—J. Henry Blake.

DR. HOWARD P. BELLOWS

Dr. Howard P. Bellows died on October 17th last, at his home in Cambridge, Mass. He had been for many years a practicing physician in Boston, and holding the position of Professor of Otology at the Medical School of Boston University.

He became a member of the Boston Malacological Club at its second meeting, in April, 1910, and in addition to being a constant attendant at its meetings, served on the executive committee in 1913–1914, and was vice-president in 1916–1917.

His collection of shells, assembled over a period of several years, contained upwards of one thousand named species. These were tropical forms, both land and marine, carefully selected for their beauty and perfection. Dr. Bellows disposed of the collection privately, a few months before his death.

NOTES AND NEWS

Dr. H. Burrington Baker will leave Philadelphia about February first for Honolulu, where he expects to work on Pacific Zonitidae and other mollusks at the B. P. Bishop Museum for about six months. First class mail will be forwarded to him. Articles for publication should be sent to Pilsbry.

We hear with deep regret of the death of Dr. Robert F. Scharff, for many years Keeper of the Natural History division of the Science and Art Museum, of Dublin. He was born at Leeds in 1858, and died Sept. 11, 1934. He was author of many papers on the fauna of Ireland, one of them dealing with the slugs, but is best known in America by his interesting volume, "Distribution and Origin of Life in America."

Nederlandsche Malacologische Vereeniging.—The Editors have received the following communication: We have the honor to inform you that a number of conchologists of Holland have founded a Society of conchologists under the name "Nederlandsche Malacologische Vereeniging." The Society intends to enlarge knowledge of the malacological fauna, especially of the Netherlands, by study of the recent and extinct marine and non-marine mollusks of Holland and its neighborhood. We shall be very happy to work in cooperation with you in all points, which shall occur in future.—Dr. J. Th. Henrard, President, and Dr. F. P. Koumans, Secretary, Leiden, Holland.

MACTRA ALATA Spengler var. SUBALATA Mörch, ON THE WEST COAST.—Range: Costa Rica, the southern shores of the Los Santos peninsula, Panamá, to Santa Elena, Ecuador. *Mactra alata* is the common West Indian *Mactrella,* recognized by the alation of its posterior-dorsal ridge and rather thin, convex, elongate shell. What appears to be a typical specimen of *alata* was figured by Reeve from Santa Elena, western Ecuador. In 1861, Mörch obtained a single right valve from Realejo, Costa Rica, which he described as *M. subalata.* These records of the occurrence of a species identical or related to the West Indian *Mactra alata,* along the Pacific coast, has generally been overlooked or considered as spurious records, based on ballast shells or in some other way transported from the Atlantic to the Pacific side (Dall, Nautilus 8, p. 42). My own collections having verified the occurrence of *alata* along the Pacific coast from several localities, the possibility of accidental transportation is entirely precluded. It is always a rare shell, and usually only a single specimen is found at a time. Both at Santa Elena and along the Panamá coast it occurs with *Mactra* (*Mactrella*) *clisia* Dall, but it is always distinct, recognized by its longer shell and absence of the small posterior gap so characteristic of *clisia.*

The features used by Mörch for the separation of *subalata* from *alata* do not appear to be constant. The Pacific shell seems generally smaller, length up to about 70 mm., and thinner than the West Indian, which is about 95 mm. long; but they are otherwise identical. Those who prefer to separate the East and West coast shells may use Mörch's name *subalata* in a varietal sense for the Pacific form. Dr. Pilsbry, who has seen my material, agrees in the above conclusions.—A. A. OLSSON.

MOLLUSCA FROM TURKEY RUN STATE PARK, INDIANA.—In the Nautilus, Vol. XLIII, p. 66, 1929, Dr. A. R. Cahn lists the Mollusca found in Turkey Run State Park, Indiana. Dr. Cahn has presented this collection to the University Natural History Museum and it has been very carefully checked with the paper above referred to. Several additional species are represented and a few corrections are necessary. These are noted below.

Polygyra profunda efasciata Walker. Two specimens among the banded forms.

Polygyra palliata (Say). One specimen with a widely open umbilicus.

Polygyra pennsylvanica (Green). Three specimens half to two-thirds the size of normal individuals. These small indivduals are almost distinct enough for varietal recognition.

Polygyra appressa perigrapta Pilsbry. One large specimen with spiral sculpture was found with small typical specimens.

Paravitrea capsella (Gould). The specimen listed as *P. multidentata* (Binney) is an immature specimen of *capsella.*

Ventridens intertexta (Binney). The *Gastrodonta ligera* listed is this species.

Helicodiscus singleyanus inermis H. B. Baker. Among the *Hawaiia minuscula* a number of this recently described race was found. It is common in Indiana and Illinois.

Strobilops aenea Pilsbry. The specimens listed as *S. labyrinthica* are *aenea.*

Gastrocopta pentodon gracilis Sterki. The *pentodon* is of this race.

Carychium exile H. C. Lea. The Carychium listed as *exiguum* is this species. FRANK C. BAKER.

HELISOMA CAMPANULATUM (Say) IN AUSTRALIA.—The species is well established at Blanchetown, South Australia, in the River Murray, where it was taken by Mrs. L. A. Elliott in April, 1933. It is said that American farm and other machinery was unloaded at this place about 20 or 30 years ago, and possibly some mud containing embryo shells was brought from America.—BERNARD C. COTTON, in *The South Australian Naturalist,* vol. 15, p. 8.

JOHNSON'S "LIST OF MARINE MOLLUSCA OF THE ATLANTIC COAST FROM LABRADOR TO TEXAS.—I will be very grateful if my attention is called to any errors in this list or to any additional species that should be included. A supplement is to be published correcting such errors and omissions.—W. J. CLENCH, Mus. Comp. Zool, Cambridge, Mass.

UNUSUAL CONCENTRATION OF LYMNAEA.—While collecting mollusks in the Rocky Mountain National Park in July, 1933, the writer happened upon an unusual massing of juvenile *Lymnaea palustris wyomingensis* Baker. A small rivulet about half a mile west of Beaver Point flows into a small slough formed by the road. At a point just above the slough the stream spread out

over an area of approximately 36 by 8 inches, and not over ¼ inch deep. In this space were 3425 specimens, by actual count of collected and cleaned shells. The snails apparently were being washed down, a few at a time, from a trout pond about a quarter-mile above.—Hugo G. Rodeck, Univ. of Colorado Museum.

Margaritifera and Fluminicola in Wyoming.—In the Stanford University collection I found specimens of *Margaritifera margaritifera falcata* (Gould) from Evanston, on Bear River, Wyoming. Dr. Wendell O. Gregg informed me, September, 1934, that he found one specimen of *Margaritifera* (almost certainly this form) in the Snake River at the mouth of Flat Creek, eight miles south of Jackson, Wyoming. Apparently this genus has not hitherto been reported from Wyoming. Dr. Gregg also sent me specimens of *Fluminicola fusca* (Haldeman) taken by him at the mouth of Flat Creek. This species had been reported from Green River and "Smith's Fork of Green River," Wyoming, by Binney, 1865, and Pilsbry, 1899, but has not since been reported from the state, so far as I know. At the Academy of Natural Sciences of Philadelphia there are specimens of this *Fluminicola* labelled as from Black's Fork, Green River, Millersville, Wyoming (No. 27769); Smith's Fork, Green River, Wyoming (Jos. Leidy, No. 27773); Wyoming (E. E. Beecher, No. 88598); North Fork of Snake River, Wyoming (H. Hemphill, No. 88948); mouth of Yellowstone River (E. D. Cope, Hayden Survey, No. 84118); and Cheyenne Pass, Dakota (J. Van A. Carter, No. 27770). North Snake River is in Idaho, not Wyoming. The Yellowstone mouth and Cheyenne Pass localities are exceedingly doubtful, as no member of this genus has been reported from within hundreds of miles thereof. The localities for many early western reports of mollusks need confirmation. This is epecially true of the reported occurrence of *Goniobasis* in Montana.—Junius Henderson.

An Invasion of Monterey Bay by Squids.—The United States National Museum has received a letter giving information regarding an unusual occurrence of an enormous number of squids in Monterey Bay, which I believe will prove of interest to all students of Cephalopods. I am therefore sending a copy of the letter for publication in The Nautilus.

"While anchored in Monterey Bay the vessel was surrounded by a very large school of squid. They were so thick they blocked all of the intakes of the ship, necessitating using the atmospheric exhaust. Orders were given to get under way at 4:00 a. m. and it was afternoon before the outlets could be cleared sufficiently to get enough circulating water through the condenser. As the weather was very thick that afternoon the ship anchored again in Monterey Bay, moving the anchorage at a considerable distance from the previous anchorage and a repetition of the same condition occurred on that night with the exception that at no time was the main circulator used, so there was no difficulty in getting under way. Finally, to avoid the trouble, a flexible rubber pipe was put over the side with a strainer at the end and connected with the large wrecking pump to run the circulating water while the vessel was at anchor. When the strainer became blocked with fish it was lifted out of the water and cleared."

(Sgd.) F. H. Hardy,
Commanding Officer, U. S. Coast &
Geodetic Survey Ship *Guide*.

"In reply to the Director's letter 21–AHH, 1995–GU–4, relative to the above subject, it is respectfully advised that the heavy schools of squid, which were sufficient to foul engine room intakes, were encountered between the approximate hours of 8:00 p. m. to 4:00 a. m. on the nights of June 4–5, 5–6, 6–7.

"The Ship *Guide*, at the time, was anchored off Monterey, in Latitude 36° 36′ 42″ N., Longitude 121° 53′ 10″ W., in ten fathoms of water, sandy bottom, and about one-half mile eastward of a rocky shoreline. The shoreline to the southward and eastward is sandy.

"The majority of the squid were between 8 and 15 inches long, and the depth of the school appeared to be about four feet. The squid surrounded the ship in all directions, but concentrated in areas illuminated by lights on the ship."

(Sgd.) G. C. Jones,
H. &. G. Engr. C. & G. S., Commanding Ship *Guide*.

Paul Bartsch.

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THE EFFECT OF POLLUTION ON MOLLUSKS IN IOWA

BY B. SHIMEK
State University of Iowa

The lake and kettlehole region of Iowa, lying within the Wisconsin glacial lobe between Spirit and Clear lakes, and known to the early visitors and settlers as "the thousand lake region," was formerly a rich field for the study of mollusks. Fresh water pulmonates, as well as prosobranchs and bivalves, were plentiful in every swamp, pond and lake, and in all the sluggish streams of that region.

Some of the species, such as *Bulimnea megasoma* and *Stagnicola emarginata*, have become quite extinct; others, like *Lymnæa stagnalis appressa, Helisoma campanulatum, H. truncatum,* etc., have been greatly reduced in numbers; and even the members of the *Stagnicola palustris* group, which once crowded every kettlehole and lake border, and such operculates of deeper waters as *Valvata tricarinata* and some of the Amnicolas, if not exterminated have become much reduced in numbers and distribution.

This result has been brought about in part by the drainage mania which caused the destruction of practically all the smaller bodies of water in the state; in part by the disappearance of many of the kettleholes following the breaking of the prairie; and in part, especially along the Mississippi River, by the various so-called "river-improvements" projects.

In recent years, however, another factor, namely lake and stream pollution, has come in to complete the work of destruction, and our once rich field for the study of fresh water mollusks is fast becoming barren.

This condition exists more or less throughout the state. Mollusks once abounded in the Iowa, Cedar and Des Moines Rivers,

but since their pollution by municipal and industrial agencies, most of the fine colonies have been destroyed and only a few scavengers remain. The Iowa River at Eldora and Iowa City, the Cedar at Cedar Rapids, and the Des Moines at various points from Estherville to its mouth, contained great numbers of specimens of species belonging to the genera *Somatogyrus, Cincinnatia, Amnicola, Campeloma,* and others, besides numerous bivalves, but after these streams were polluted practically all of this fauna disappeared. The Mississippi and some of its other tributaries, as well as the streams tributary to the Missouri, have suffered likewise.

In more recent years even our larger lakes have been similarly afflicted. Thus, some twenty-five years ago the writer made a creditable collection of fresh water mollusks from Storm Lake, but since the pollution of that lake by municipal sewage, only a few scavenger Physas seem to remain.

Many other similar cases might be cited, but perhaps the most complete and most heart-breaking destruction of a molluscan fauna has taken place in the formerly fine, and malacologically rich Okoboji Lakes, and their extension, the Gar Lakes.

In the somewhat deeper parts of these lakes (at depths down to about 30 feet) it was formerly possible to dredge large numbers of aquatic mollusks, a six-inch dipper-dredge usually bringing up from 25 to more than 100 specimens at each haul. In the deeper parts living specimens of *Valvata tricarinata, V. bicarinata, Amnicola limosa* and *lustrica, Cincinnatia cincinnatiensis, judayi* and *emarginata,* several species of *Musculium, Sphaerium,* and *Pisidium,* and numbers of *Lampsilis luteolus* and *Anodonta footiana* could be secured; while in shallower waters, or on beds of *Potamogeton, Myriophyllum, Ceratophyllum, Elodea,* etc., the following occurred more or less frequently: *Helisoma antrosum, campanulatum* and *truncatum, Gyraulus hirsutus* and *parvus, Menetus exacuous, Stagnicola emarginata* and other species of this genus, *Physa halei, anatina* and *gyrina, Ferrissia fusca* and *parallela,* and *Campeloma decisum.*

In August, 1933, after a five-year neglect of this phase of the work at the lakes, the writer again attempted to dredge at various points in these lakes, particularly in East and West Okoboji

and the Gar Lakes, where mollusks were formerly abundant, and *not a single living specimen was secured,* though great numbers of old bleached shells were brought up.

During the past summer, in July and August, 1934, the effort was repeated several times with essentially the same result, excepting that at one point, where an unpolluted streamlet enters the west lake, two or three living specimens of *Physa halei* were observed. At the same time Mr. Earl T. Rose, who was employed in research work for the Iowa State Fish and Game Commission, similarly dredged in various parts of East Okoboji Lake, with like results.

It is therefore evident that comparatively recently there has been a practically complete destruction of the molluscan fauna of these lakes, once so rich and abundant. Other damage, of course, was done, but we are not concerned with that in this connection.

The causes of this destruction are very clear. In the main it is due to the fact that the towns of Orleans, Spirit Lake and Arnolds Park have been discharging the effluent from their sewage disposal plants, or the sewage itself, chiefly into East Okoboji Lake, which connects with West Okoboji, the Gar Lakes and the Little Sioux River. In addition to this there has been much pollution from cottages and resorts, and from stock which has been permitted to wade in the shallow places.

East Lake Okoboji and the Gar Lakes, being more closely connected along the drainage outlet, have been more directly affected, but east winds drive the befouled waters of East Okoboji into those of the west lake, until finally the entire system has been polluted.

A movement is on foot, through the efforts of the Iowa State Board of Conservation, to stop the discharge of sewage into the lakes. If this succeeds, and it must if the lakes are not to be completely ruined, the study of the come-back of the molluscan fauna, now so completely destroyed, will be of exceeding interest. Fortunately very full records (with specimens) of the original fauna are preserved, and the facilities of the Iowa Lakeside Laboratory will be available for the study of the future changes.

GASTROPODS OF THE DAVIS MOUNTAINS VICINITY IN WEST TEXAS[1]

BY ELMER P. CHEATUM
Southern Methodist University, Dallas, Texas
(Plate 5)

During the early part of September, 1934, the writer and Professor Mayne Longnecker, botanist of Southern Methodist University, spent a week in the Davis Mountains studying the vegetation and mollusks of that region.[1] Faunistically the area is little known, although its geology has been partially investigated (Baker and Bowman, Univ. of Tex. Bull. No. 1735, 1917).

The Davis Mountains are a part of the front range of the Cordillera and are entirely of igneous origin. As a whole, they form an irregular plateau built up of alternating layers of lava and volcanic tuff. The highest ridges reach, in Baldy or Livermore Peak, the second highest altitude in Texas (8,382 feet), and consist of an intrusive porphyritic syenite. Deep narrow canyons, the result of erosion, finger back into the main plateau.

The high range loomed up far above the surrounding ranges as we approach the Davis Mountains from the north. Its rich verdure contrasted sharply with the blue-gray colors of the surrounding ranges; like an oasis in the desert. As we entered the mountains on our road to Fort Davis, we drove into the narrow neck of Limpia Canyon, one of the largest canyons in the range. Its walls, composed of alternating layers of lava beds and volcanic tuff, consists of irregular-shaped blocks resembling rude masonry. Pillars, formed of columnar jointing in the lava beds, give rise to precipitous cliffs reaching at times an altitude of several hundred feet. The canyon widens and becomes shallower as it approaches Fort Davis, the county seat of Jeff Davis County, forming a bench from eight to ten miles broad. Just north of Ft. Davis, Limpia canyon continues westward as a narrow canyon terminating in the main plateau. Our headquarters were at Fort Davis, which served admirably as a nucleus for collecting trips because of its central location.

[1] The writer is indebted to W. J. Clench for the identification of physids and to Dr. Henry A. Pilsbry for the identification of the remaining species and descriptions of the three new ones.

The annual precipitation for these mountains is greater than that for the lower surrounding ranges; and since our trip was made after several rains, conditions for general collecting were very good. Collecting trips were made to the larger canyons such as Limpia, Musquiz, Madera, and in several of the smaller ones. After heavy rains the stream bed of each canyon may become a raging torrent; but ordinarily they are dry, with perhaps a series of pot-holes (Figs. 2, 3) either dry or partly filled with water. These pot-holes, cut in the lava bed by the erosive action of water and molar agents, vary considerably in size. Ordinarily they are basin-like, some wide and shallow, others narrow and deep. Many appear to be continuously fed by seepage water. Such basins often provided rich collecting for *Physa* and *Helisoma*. The relatively larger number of springs in the Davis Mountains canyons has been accounted for by Baker and Bowman (1917) as follows: "The water absorbed by the lavas in the Davis Mountains region seeps downward through the rocks until its further progress downward is checked by non-porous beds. At the junction of the impervious rocks below and the porous tuff bed which generally underlies the lowest lava flow, the water accumulates and escapes as springs at the edges of the lava escarpment and where the canyons have cut as deep as the basal tuff bed." Although land snails were unusually scarce even in well protected habitats, our best collections were made at the heads of small canyons where springs occurred and vegetation abundant. The more exposed mountain sides and plateaus were searched diligently, but in vain, for land snails. No living snails were discovered in the open areas.

AMNICOLIDAE

Cochliopa texana Pils. (A new species, see page 91). Collected in Phantom Lake, about four and one-half miles southwest of Toyahvale. The "lake" is in reality a small circular pond (about 75 yards in diameter), fed by a large spring. The swift stream (Fig. 4) of clear alkaline water flowing from the pond had a width of fifteen feet, and ranged in depth from several inches to five or six feet. The bottom of the pond and stream was covered with *Chara,* and a marl-forming alga pro-

ducing a thin greyish crust over the bottom and sides of the stream bed. The aquatic vegetation in the stream was black, in places, with living *Cochliopa* and *Potamopyrgus*. One sweep among this vegetation with a dip-net (12 inches in diameter) yielded approximately 4080 snails, of which the majority were *Cochliopa*. Apparently these two species were sharply localized in their distribution, since a close examination of this same stream a mile down-stream failed to reveal any of these small snails.

Potamopyrgus cheatumi Pils. (Page 91). Habitat same as that for *Cochliopa texana*.

PHYSIDAE

Physa anatina Lea. Collected from pot-holes in Limpia, Musquiz and Fern canyons; abundant in large reservoir along Scenic Drive just northwest of Fort Davis. Small black tapering shells were found in Kokernot Creek in Musquiz canyon. Although they are of this species, Mr. W. J. Clench says they are not typical. Very few physids were found in flowing water; practically all were collected from pot-holes.

LYMNAEIDAE

Lymnaea dalli Baker. Collected in drift along Kokernot Creek, Musquiz Canyon, between Fort Davis and Alpine. No living specimens were taken.

Lymnaea parva Lea. From the same locality as *L. dalli*.

PLANORBIDAE

Helisoma trivolvis lentum (Say). This predominating species occurred in pot-holes. Some of the pot-holes were so deeply imbedded between rocky ledges that they were constantly shaded, yet the walls of these holes were literally plastered with *Helisoma* having dark colored shells, many of them black. Collected along Scenic Drive about one mile northwest of Ft. Davis; Limpia and Musquiz Canyons; and several small canyons within the range.

PUPILLIDAE

Gastrocopta pellucida hordeacella (Pils.). One specimen was found in a bed of humus deposited by Texan oak trees (*Quercus*

texana) about eight miles north of Fort Davis in Limpia Canyon.

Gastrocopta riograndensis Sterki (?). Collected in same habitat as *G. pellucida hordeacella.* Dr. Pilsbry is not certain of the identification since the shell is possibly that of a juvenile specimen.

Gastrocopta pentodon (Say). Collected in same habitat as *G. pellucida hordeacella.*

ZONITIDAE

Retinella indentata paucilirata (Morel.). One young and one adult were found at the head of Fern Canyon (Fig. 1) buried beneath a bed of humus deposited by a group of *Crataegus* trees. The soil was moist with seepage water from a nearby spring. Several dead shells were collected in drift along Kokernot Creek, Musquiz Canyon.

Zonitoides arboreus (Say) (?). From the same habitat as *G. pellucida hordeacella.* Since the animal was immature, Dr. Pilsbry made no positive identification.

Hawaiia minuscula neomexicana (Ckll. & Pils.). Collected from the same habitat as *G. pellucida hordeacella.*

ENDODONTIDAE

Helicodiscus singleyanus (Pils.). Collected in drift along Kokernot Creek, Musquiz Canyon, between Ft. Davis and Alpine.

Helicodiscus parallelus (Say). One specimen was collected near a large reservoir one mile northwest of Ft. Davis. This was found on a rocky ledge covered by a bed of cactus humus.

HELICIDAE

Humboldtiana cheatumi Pils. (A new species, see p. 93). Found at the head of a small canyon tributary to Limpia Canyon, about five miles north of Ft. Davis. At the head of this canyon was an abandoned water-wheel. Seepage water from the spring above fed the small stream in the canyon bed. The collecting area was well shaded by a group of Texan oaks (*Quercus texana*). An intensive search of four or five hours, conducted by four people, netted only seven living specimens

and six dead shells. The living snails were taken from the sides of the large rocks beneath the rocky ledges, all apparently restricted to the shaded area.

Thysanophora hornii (Gabb). One dead shell was found in the same habitat as that described for *R. indentata paucilirata.*

SUCCINEIDAE

Succinea avara Say. Collected in Fern Canyon; attached to a moist rocky ledge partially covered with maiden-hair ferns, mosses and liverworts. Also taken in Musquiz and Limpia Canyons. In Musquiz this species was found moving about over the edges of pot-holes (Fig. 2) and over the rank grass (*Bouteloua*) that covered marshy places in the canyon bed.

NEW MOLLUSKS FROM THE PANAMIC PROVINCE

BY HENRY A. PILSBRY AND AXEL A. OLSSON

(Plate 6)

VERMETIDAE

Petaloconchus innumerabilis n. sp. Plate 6, figs. 8, 8*a*, 8*b*.

Punta Picos, near Boca Pan, Province of Tumbez, Peru. (Olsson), type, 164626. ANSP.

A vermetid growing in compact, closely interlaced masses. The initial stage is glossy, globose-conic, of about 1½ whorls; followed by a loosely coiled stage with tube at first with indistinct, incremental sculpture only, about 0.7 mm. diameter. This is followed by a closely coiled, strongly sculptured stage, the 8–12 whorls generally in close contact; then a loosely coiled, corkscrew stage follows, gradually becoming more drawn out, and about 1.5 to 2 mm. diameter. Sculpture of coarse, irregular cords parallel to the whorls, or sometimes more strongly spiral in places, and rather coarse but unevenly developed striae of growth. In the closely coiled stage, there are two columellar lamellae (figs. 8*a*, 8*b*, the posterior one double the size of the anterior, usually thin and simple, but in some whorls it is bifid or trifid; the smaller lamellae is also bifid in places. In the later whorls of the tube, these lamellae disappear. Individual shells appear to be 50 or 60 mm. long, and up to 2 or 2.3 mm. in diameter at the anterior end.

The group of which part is figured, is about 23 cm. long. It was found on the beach. It grows in large masses, like *P. varians*

2

1

3

4

1, View at head of Fern Canyon. 2, Pothole in Musquiz Canyon. 3, Pothole deep in igneous rocks. 4, Stream flowing from Phantom Lake.

Orb. In this mass three generations appear to be superposed one above another, parts of two shown in the figure.

Nuculanidae

Nuculana (Adrana) suprema n. sp. Plate 6, fig. 1.

Beach between Port Guanico and the mouth of the Guanico river, Los Santos province, Panamá (Olsson), type 164608 ANSP.

The shell is long, strongly compressed, subequilateral, with dark olive-brown epidermis (largely or wholly lost in specimens seen); glossy. The dorsal outline is nearly straight, the ventral margin gently convex, straightened or slightly concave towards the posterior end, the greatest height being about the anterior third of the length. Anterior end more obtuse than the posterior. Dorsal areas extremely narrow, bounded by inconspicuous angles. Sculpture of weak growth lines and excessively fine and clear-cut longitudinal striae, obliquely crossing the lines of growth posteriorly, mainly curving with them in the anterior half. They are wanting in a band along the dorsal side, but extend nearly to the ends. Interior white, the pallial sinus occupying more than one-third of the total length, truncate at the end. Tooth row long, occupying 60% of the whole length, anterior and posterior series of about equal length, teeth very small, V-shaped. Cartilage pit very shallow, about 10 mm., long in the type. Length 107 mm., height 23.5 mm., semi-diameter 4.6 mm.

The largest *Adrana,* distinguished also by the central beaks, those of *N. elongata* Sowerby being a little anterior.

Nuculana (Adrana) tonosiana n. sp. Plate 6, fig. 4.

Estero Bucaru, mouth of the Tonosi River, Los Santos, Panamá. Type 164025 ANSP., paratypes in Olsson collection.

The shell is small for this group, elongate, strongly compressed, subequilateral, white to pale cream-color. The beaks are small, a little anterior of the middle. The dorsal margin is weakly arched by the beaks to nearly straight. The anterior end is bluntly angular at the termination of the dorsal margin, rounded below. Posterior end lower than the anterior, slightly pointed, elevated at its junction with the dorsal margin. Posterior-dorsal area long and narrowly lanceolate, smooth, bounded by a strongly crenulated ridge, the anterior-dorsal area similar and smaller, with the bounding carina only weakly crenulated.

The sculpture consists of fine, regular, raised threads over the middle of the surface, but which become stronger and a little irregular in the vicinity of the dorsal margins. Near the anterior-dorsal margin, these threads are wavy and irregular, while some are seen to bifurcate. At the posterior end, there is a bordering, narrow band across which the threads become smoother but give rise to coarse crenulations on the posterior carina. Tooth band narrow, the posterior set of teeth, about a fourth longer than the anterior. Teeth very numerous in each set, very small in the middle, becoming progressively larger towards the ends. Pallial sinus ample, extending to the posterior quarter. Interior white to glassy. Valves gaping slightly at both ends. Length 25.5 mm., height 7 mm., diameter 3 mm.

This species resembles a young *N. arcuata* Sowerby but is distinguished by details of its sculpture. In *arcuata,* the thread-like ribs are regular over the whole surface and not noticeably stronger or waved along the anterior-dorsal margins as in our species. The present species is also constantly smaller, our collection containing more than 24 shells none of which exceeds 26 mm. in length.

N. arcuata (Plate 6, figs. 2, 3) is abundant along the north Peruvian and Ecuadorian coast, and measures from 31 to 42 mm. in length. The specimens figured are from Point Ancon, Santa Elena, Ecuador. The identification was confirmed by Mr. LeB. Tomlin, from the type in B. M.

PERIPLOMATIDAE

ALBIMANUS new subgenus of *Periploma* Schumacher. Shell strongly inequilateral and inequivalve, longer than high, with 5 strong, radiating ribs projecting at the margins; beaks not slit. Type *P. (A.) pentadactylus.*

Periploma (Albimanus) pentadactylus n. sp. Plate 6, figs. 5, 6, 7.

Beach between Port Guanico and the mouth of the Guanico river, Los Santos province, Panamá (Olsson), type 164610 ANSP.; paratypes in Olsson collection.

The shell is white, oblong, much longer than high, plump, conspicuously inequivalve, the right valve being strongly convex, the left valve weakly convex. Right valve (figs. 5, 6) with a wide beak at the posterior fifth of the length, a deep, escutcheon-

like area defined by a rib; dorsal margin strongly arched, posterior margin truncate, anterior end running out in a point, basal margin trilobed. Sculpture of five, radiating ribs, the second and the fourth bifid, the third less distinctly so, the first rib simple, running to the anterior basal extremity, the small fifth rib bounds the escutcheon. Delicate lines of growth are festooned between the ribs. The external ribs project also in the interior. Left valve (fig. 7) with very weak ribs corresponding to those of the right. The left valve is smaller than the right. The hinge line is thin, with a small, strongly oblique chondrophore. The pallial sinus extends to between a third and a half of the total length.

Length 21.3 mm., height 15.3 mm., diameter 7 mm. Type.
Length 21 mm., height 13 mm. Paratype.

The ribs begin when the shell is 3.5 to 4 mm. long. In the type species of *Periploma* and *P. angulifera* Phil., of the Caribbean region, there is a rib bounding the short posterior end, but we have found none with sculpture resembling this one.

Mactridae

Tumbeziconcha, new subgenus of *Mactra.* Shell thin, concentrically plicate, like *Raeta,* but the plicae oblique across the posterior portion, and with irregular concentric wrinkles of growth (not vermiculate, as in *Raeta*); posterior-dorsal areas defined simply by the ending of the plicae, not marked off by an angle or keel. Pallial sinus extending beyond the middle. Hinge as in *Mactrella.* Genotype *Mactra thracioides* Adams & Reeve, Plate 6, fig. 9.

In external form and sculpture, *Tumbeziconcha* resembles *Raeta* more closely than it does the plicate Mactras such as *Harvella* and *Mactrinula.* It is in the hinge structure that the shell shows its relationship with the true Mactras and particularly to *Mactrella.* The hinge is fully developed and is quite similar to that of *Harvella elegans.* The ligamental scar is distinct and separated from the chondrophore by a thickened lamina. The posterior arm of the cardinal tooth lies along the anterior side of the chondrophore, its upper end fused with the anterior arm. Lateral teeth are strong, those of the left valve fitting between two laminae in the right.

In outline the shell is shortly subelliptical but with the beaks in front of the middle, so that the posterior end is somewhat

longer, lower and narrower than the anterior. The external sculpture consists of deep waves or undulations which differ from those of *Harvella* and *Raeta* in not being strictly concentric; they become oblique across the middle and posterior portions of the valves. The posterior-dorsal area is defined by the sudden ending of the ribs and not marked off by a keel or angled ridge as in *Mactrella, Harvella* and *Mactrinula.* The surface is covered with fine, irregular, concentric incremental wrinkles, as if it had been painted with a coarse brush. There is sometimes a faint ridge extending across the anterior side of the umbo to the ventral margin.

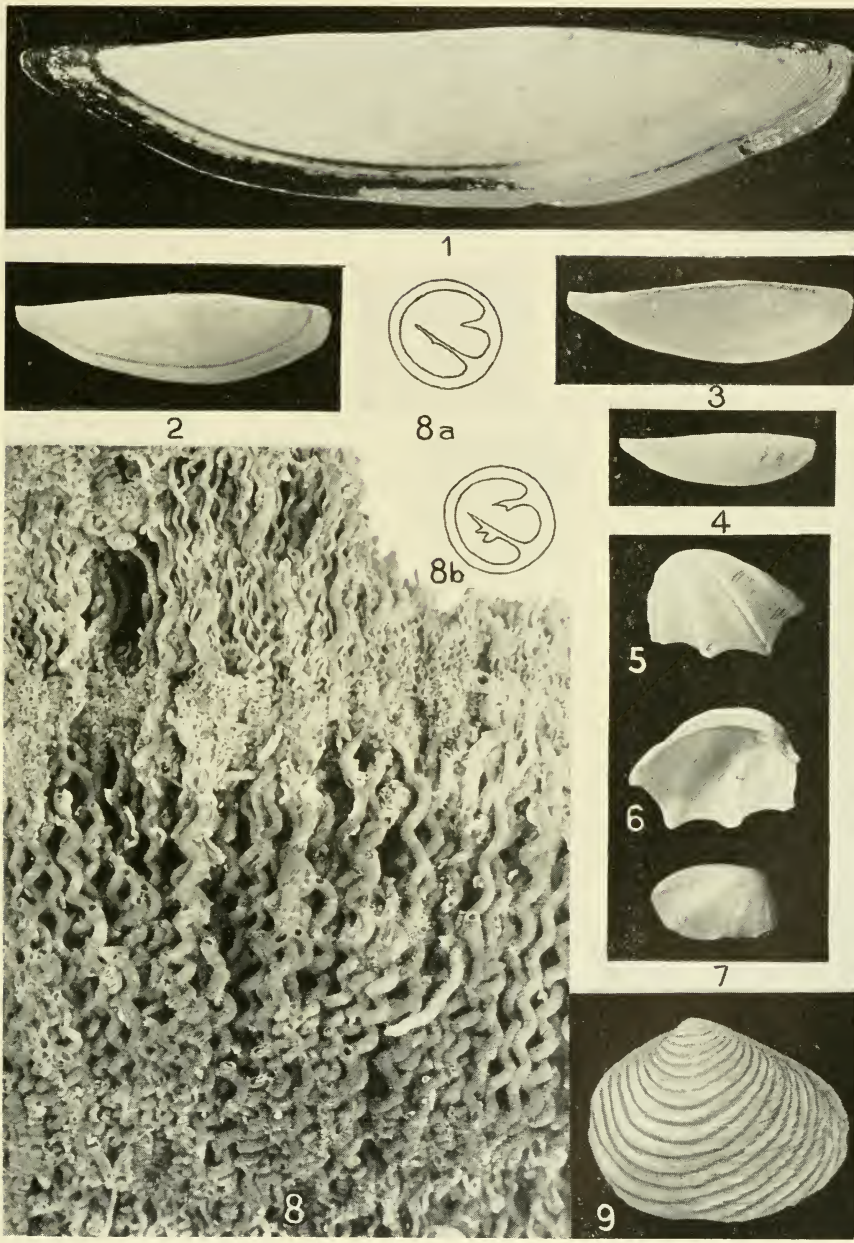
The peculiarly oblique or *Cyathodonta*-like sculpture imparts to the valves an abnormal appearance as if they had been broken across the anterior side. It is a small shell, usually about 30 millimeters long, but sometimes reaching 42 millimeters.

Length	42.5,	height	31.7 mm.,	semi-diam.	10 mm.;	right valve.
"	42.2,	"	33.0 "	"	11 "	left valve.
"	42.0,	"	31.5 "	"	10 "	right valve.
"	34.0,	"	26.2 "	"	8 "	left valve.

This species is quite common on the tidal flats at the mouth of the Tumbez river in northern Peru[1] where it is associated with *Dosinia dunkeri, Arca labiata, Modiolus tumbezensis* and *Panamicorbula inflata.* These mudflats, forming a narrow fringe in front of extensive mangrove swamps, are the home of swarms of fiddler crabs, dominated by the "maestro sastre" (*Uca princeps* Smith), whose large, flat, left cheliped flashes like the metallic blades of a pair of shears in the brilliant tropical sunlight. To these mud flats come various shore birds, among them many herons, spoonbills and ibises.

Mactra thracioides was described as from the "Eastern Seas" (A. Adams and Reeve, 1848, Zool. Voy. H.M.S. "Samarang," Mollusca, p. 81). No more definite locality seems to have been given until it was reported from Ecuador by Lamy, 1917, and from La Union, Salvador, in the Gulf of Fonseca, by Pilsbry

[1] A single valve was reported by E. Lamy from Machala, Ecuador, under the name *Standella thracioides* Ads. & Rve. It was given to the Paris Museum by Jousseaume. This was in all probability collected by M. Auguste Cousin, whose Ecuadorian collection was partly worked up by Dr. Jousseaume in 1887. See Révision Mactridae Mus. d'Hist. Nat. Paris, in Journ. de Conch. 63: 386. 1917.



1, Nuculana suprema.
2, 3, Nuculana arcuata (Sowb.).
4, Nuculana tonosiana.
5–7, Periploma pentadactylus.
8–8b, Petaloconchus innumerabilis.
9, Mactra thracioides A. & R.

and Lowe, from specimens collected by the latter (Proc. A.N.S. Phila. 1932, p. 131). It has been taken by one of us (A.A.O.) at Port Pizarro and Tumbez River, in northern Peru. These shells agree fully with the original account and figure of *thracioides,* but to eliminate all doubt we sent a specimen to Mr. J. R. Le B. Tomlin, who writes: "I compared it with the type of *M. thracioides* Ads. & Rve., and it is absolutely identical. We have the specimen figured in the 'Samarang,' pl. 23, fig. 8. It was purchased from Mrs. Lombe Taylor after her husband's death. It measures 36 mm. in length. It is just luck if we have any of the types from the 'Samarang' or other early voyages, such as the 'Sulphur.' At that time the collections seem to have been the Captain's perquisite, and Belcher, who was a collector, absorbed all the more showy material. Belcher's collection was sold at auction. After Cuming's death, Lombe Taylor, who was a well-to-do country squire, seems to have mopped up whatever was on the market from time to time."

In the years 1836–42 H. M. S. "Sulphur," Captain Sir Edward Belcher, surveyed from northern Peru to Sitka. Collections were made in many places, among them in the Gulf of Fonseca (where Lowe picked it up many years later). It is believed that Captain Belcher got *M. thracioides* during this exploration, but did not turn it in for description until after the voyage of the "Samarang," 1843–46, which he also commanded. By that time the origin of the clam was forgotten, and the vague habitat "Eastern Seas" was assigned in the lack of any definite locality.

(*To be continued*)

NEW RACES OF LIGUUS FROM FLORIDA AND CUBA

BY WILLIAM J. CLENCH

(Plate 7)

Liguus fasciatus deckerti, herein described, was collected by Mr. Schevill and the author in lower Florida during the winter of 1930. No additional specimens of this form have come to hand and it now seems best that it should be described.

During September of 1934 the author, with C. V. MacCoy and

H. D. Russell, spent several days at Viñales, for the purpose of collecting and studying the distribution of *Liguus* in this 'mogote' region. A single new race was encountered that was not obtained by Mr. Archer during his stay at this locality in 1930. Through the courtesy and kindness of Sr. L. Pequeño of Pinar del Rio, two additional races were presented for study and description. The figures are from holotypes.

Liguus fasciatus deckerti, subsp. nov. Plate 7, fig. 4.

Description.—This form is a parallel of *L. f. castaneozonatus* Pils. and differs only in possessing a white tip and columellar region. It is exceedingly rare, a fact quite remarkable inasmuch as *castaneozonatus,* from which this form is apparently derived, is perhaps the most abundant *Liguus* in Florida. So far as known it does not occur as a pure race.

Length 44.5,	width 24.8,	aperture	20.8 x 13.4 mm.	Holotype
" 43.0,	" 23.5,	"	20.5 x 13.2 mm.	Paratype
" 40.5,	" 23.1,	"	19.0 x 13.0 mm.	"
" 38.5,	" 22.0,	"	19.0 x 12.0 mm.	"
" 28.0,	" 21.8,	"	18.5 x 11.5 mm.	"

All measured shells of $6\frac{3}{4}$ to 7 whorls each.

Holotype.—M. C. Z. 81549, Hammock no. 55, eastern end of Long Pine Key, south central everglades, Florida. W. J. Clench and W. E. Schevill collectors, February, 1930. Paratypes from the same locality. A series of three specimens were collected in Brickell Hammock, Miami, by J. N. Farnum in 1926.

Named for Richard F. Deckert of Miami, Florida, who has explored much of the Everglades collecting Liguus. This is probably the rarest of all Florida *Liguus.* Racial elements from many of the lower chain of keys, of course, have become exterminated, but in the days of their discovery they were probably fairly abundant. It is all the more remarkable that this derivative race should be from one that is perhaps the most abundant and at the same time the most widely distributed in lower Florida. With but few exceptions, all other parallel elements of the many color forms exist in about equal numbers if an average is taken throughout the distributional area for each race. Where such discrepancies exist, the numerical ratio is nowhere near so marked.

Liguus fasciatus mariae, subsp. nov. Plate 7, fig. 3.

Description.—Shell somewhat solid, elongate and shining. Whorls 8, rather strongly convex. Color: ground color white, banded above and below the periphery with broad bands of orange brown, pale or even absent on the early whorls, usually deep in color just behind the palatal margin. A hair-like line of the same color may split the narrow peripheral area of white. Green periostracal lines few or absent. Columella noticeably thickened on its inner margin, almost in the form of a vertical tooth or fold. Parietal wall white and somewhat calloused.

Length 59.0,	width 25.0,	aperture	23.5 x 12.5 mm.	Holotype
" 59.5,	" 24.5,	"	23.0 x 12.5 mm.	Paratype
" 57.5,	" 25.5,	"	23.0 x 12.5 mm.	"
" 56.5,	" 24.5,	"	22.0 x 13.0 mm.	"
" 54.0,	" 25.5,	"	23.5 x 12.5 mm.	"

All measured shells of 8 whorls each.

Holotype.—M. C. Z. no. 94224, Ojo de Agua, near Cayo Magueyal, Pinar del Rio, Cuba. Ex. Sr. L. Pequeño.

Remarks.—This race is quite sharply differentiated from all other races of *fasciatus* in Pinar del Rio. It is not to be confused with *L. f. xanthus* Cl. which is similarly banded, though with yellow rather than brownish yellow. It differs entirely from this latter race as well by possessing more convex whorls, the presence of the columellar tooth or fold and in being a much larger shell. Cayo Magueyal, according to Sr. Pequeño, is not a true cay or key in the island sense but an area of broad-leaf trees apparently similar to the hammocks occurring in the Florida Everglades.

At the request of Señor Pequeño I take pleasure in naming this species after Sra. Maria Pequeño.

Liguus blainianus pilsbryi, subsp. nov. Plate 7, fig. 1.

Description.—Shell subsolid, produced and somewhat shining. Whorls 7, flat to slightly convex. Spire acute. Color: first whorl blackish brown, shading abruptly into dull pink, the latter color continuing for 1½ whorls; from 2½ whorl onwards the pink color fades into a ground color of white which is overlaid with wide supra- and infra-peripheral bands of strong axial flames. These flames are dark, blackish brown, alternating with intense yellowish orange interspaces, pale on the early whorls and much deeper in coloration on the body whorl. Peripheral line (1½ mm. in width) dark blackish brown and margined with the white

ground color. In addition, there is a narrow infra-sutural line of the same dark color. The peripheral line forms the supra-sutural line of the early whorls. The infra-peripheral band is margined below by a narrow line of the white ground color. Inner face of columella white, margined behind by deep pink and with the entire pink area encircled by a narrow line of brown. Parietal wall glazed white, usually transparent enough to see the coloration of the body whorl. Periostracal green lines absent on the type series.

Length 45.4	width 20.0,	aperture	20.5 x 11.5	mm.	Holotype
" 44.0,	" 20.2,	"	19.0 x 11.6	mm.	Paratype
" 42.0,	" 19.1,	"	17.5 x 11.5	mm.	"
" 41.0,	" 18.0,	"	16.5 x 9.5	mm.	"
" 40.5,	" 19.0,	"	18.8 x 11.0	mm.	"

All measured specimens of 7 whorls each.

Holotype.—M. C. Z. no. 94212, Campo de Tiro, 7 km. N. of Fierro, Pinar del Rio, Cuba. Ex. L. Pequeño. Paratypes from the above locality and from higher altitudes in the Sierra de Rangel, due north of Santa Cruz de los Pinos. This latter locality is only a few kilometers east of Campo de Tiro.

Remarks.—Closely related to the typical form, differing from it in the much greater width of the supra- and infra-peripheral bands and in an increased number of the flames. These differences are probably far more apparent than real, though there is no question about two different races being involved. Dr. Bermudez reports that the typical form, *L. blainianus blainianus,* is found most abundantly at the base of the mountains at Rangel, whereas *L. b. pilsbry* is a race of the higher altitudes. Sr. L. Pequeño stated that Campo de Tiro is in the mountains, which bears out the statement of Dr. Bermudez regarding their altitudinal distribution.

Named for Dr. H. A. Pilsbry who was first to recognize the complex color races of this genus existing in Florida.

Liguus flammellus russelli, subsp. nov. Plate 7, fig. 2.

Description.—Structural characters similar in all respects to *Liguus flammellus flammellus* Cl., differing only in coloration. The earlier three whorls are pure porcelain white, not pale ivory or pale pinkish as in the typical form. The green superimposed color is much lighter and shades more toward light grayish green.

Length 46.8,	width 21.5,	aperture	19.5 x 10.7 mm.	Holotype
" 51.5,	" 22.0,	"	20.0 x 11.7 mm.	Paratype
" 51.0,	" 23.7,	"	22.6 x 12.5 mm.	"
" 48.5,	" 22.5,	"	21.6 x 12.0 mm.	"
" 48.2,	" 21.0,	"	19.5 x 11.5 mm.	"

All measured shells of 7 whorls.

Holotype.—M. C. Z. no. 82980, Mogote Mina Constancia, Viñales, Pinar del Rio, Cuba. Collected by Julio Armenteros, 1934.

Paratypes.—All of the following in the vicinity of Viñales. Mogotes: Mina Constancia; José Maria Garcia; Lorenzo Lopez; de Roja; Abascal. Also at Ensenada Martin Maranda; Ancon. and La Chorrera, Baños de San Vicente. Collected by J. Armenteros, W. J. Clench, C. V. MacCoy and H. D. Russell.

A single lot, obtained from Sr. Armenteros, is from San Andres, Canalete, Consolacion del Norte, which is located some 20 km. N. E. of Viñales. This last extends the range of the species proper more than 10 km. beyond any previously published locality.

Remarks.—This race appear to be a direct derivative of *L. flammellus flammellus.* It is very rare at all the localities as only 48 specimens of this form occurred in over 3000 of this species from this region. None of the remaining color forms occurring at Viñales exhibit this whitish phase. It is perhaps to be regarded as a partial albino in which a reduction has taken place only with the ground color. It is not to be confused, however, with *L. f. organensis* Cl. which is the true albinistic form of the *flammellus* complex. This last is white with a very pale yellowish cast with an occasional green spiral color line. Both of these latter colors are, however, invested in the periostracum. Named for Mr. H. D. Russell.

Corrections.—In my paper (Occ. Pap. Boston Soc. Nat. Hist. 8, Feb. 1934) the original reference for *Liguus fasciatus pictus* (Reeve), p. 103, should be: Proc. Zool. Soc. London, p. 56, 1842; Conchologica Systematica 2, pl. 178, fig. 10, 1842.

To the type locality given for *L. flammellus organensis* (p. 124) Mogote el Queque should follow Ensenada del Valle. This locality is in the immediate vicinity of Viñales and not in the valley of San Vicente.

A NEW SUBGENUS AND A NEW SPECIES OF PLACOSTYLUS FROM THE SOLOMON ISLANDS

BY W. J. CLENCH

ACROSTYLUS, subgenus nov. Characterized by possessing a single color (red, reddish brown or greenish), an acute spire with flat to slightly convex whorls and the lip of the aperture colored red or white. No secondary coloration exists, such as blotches or stripes, which, in most other members of related groups, is superimposed upon the ground coloration. Sculpture is reduced to the fine growth lines or at most a very fine, microscopic malleation on the later whorls. Nuclear whorls minutely pitted. Subgenotype, *Placostylus* (*Acrostylus*) *acutus*.

Placostylus (Acrostylus) acutus, species nov. Plate 7, fig. 6.

Description.—Shell rather thick, rimately umbilicate, elongate and compressed dorsoventrally. Color of shell pale reddish brown, periostracum a deep reddish brown. Whorls $5\frac{3}{4}$, rather convex. Spire produced and sharply tapering. Aperture ovate. Peristome grayish in color and very sharply reflexed, with a definite thickening within the aperture. Parietal wall calloused and supporting a very strong tooth. Columella spirally developed, its basal portion thickened and forming a false lamella. Sutures indented. Sculpture of fine irregular growth lines with faint malleations on the body whorl. Spire forms an angle of 42°, aperture cast at an angle of 14° from the axis.
Length 67.5, width 31, aperture 30 x 13 mm. Holotype

Holotype: M. C. Z. 93953, Wanderer Bay, Guadalcanar, Solomon Islands. E. Paravicini collector.

Remarks. Related to *Placostylus* (*Acrostylus*) *calus* Smith (Malaita Island) from which it differs by being smaller, having more convex whorls and a more rounded aperture. *P. calus* and *P. acutus* are the only known members of this subgenus.

NEW CARIBBEAN MARINE SHELLS

BY HARALD A. REHDER[1]

(Plate 7)

In the preparation for publication of Charles W. Johnson's "List of Marine Mollusca of the Atlantic Coast from Labrador to Texas" William J. Clench came across several names given by Dr. Dall of species which had never been described, but which had appeared as *nomina nuda* in faunistic literature. On communicating with me concerning these names, I looked up the type lots, and wrote out descriptions of the three species in question, which appear now, together with figures, in this paper.

Modiolus (Amygdalum) sagittatus, new species. Plate 7, figs. 11, 12.

1889. *Modiola picta sagittata* Dall, Bull. 37, U. S. Nat. Mus., p. 38. [n.n.]

1934. *Modiolus politus sagittatus,* Johnson, Proc. Boston Soc. Nat. Hist., vol. 40, p. 28. [n.n.]

Shell rather small, thin, moderately inflated; in outline ovate, posteriorly broadly convex, anteriorly somewhat attenuated; in general, similar in shape to *Modiolus politus* V. & S. Color opaque ivory white, except for a triangular area running from the beaks to the posterior margin, which is closely maculated with longish, transparent spots. Umbos rather prominent, situated one-eighth of the total length from the anterior end. Surface smooth, glossy, without sculpture, except for microscopic growth lines.

The holotype (U.S.N.M. no. 93999), from the Gulf of Mexico, off Cape San Blas, Florida (U.S.B.F. sta. 2400) measures: length 16.8 mm., height 9.0 mm., breadth 4.6 mm. A paratype, from the same lot, has the following measurements: length 15.5 mm., height 7.9 mm., breadth 4.3 mm., while a specimen from off Cape Florida (U.S.N.M. no. 93406) measures: length 17.9 mm., height 9.1 mm., breadth 4.6 mm.

This species has so far been found in only two areas, in 85 fathoms off Cape Florida, on the east coast of Florida, and in 111–196 fathoms off Cape San Blas, Florida, in the Gulf of Mexico.

[1] Published by permission of the Secretary of the Smithsonian Institution.

Dall considered this a subspecies of *Modiolus politus* Verrill and Smith. I believe it should be accorded specific rank, differing from that species in being less inflated, and in possessing a different and unique pattern of color-markings. It is much closer to *M. pallidulus* Dall from California, which has the same general coloration, but it is not so prominent nor so contrasted.

Pseudomalaxis (Paurodiscus) lamellifera, new subgenus, new species. Plate 7, figs. 8–10.

1889. *Omalaxis lamellifera* Dall, Bull. 37, U. S. Nat. Mus., p. 148. [n.n.]
1892. *Discohelix* (*Discosolis*) *lamellifera,* Dall, Trans. Wagner Free Inst., vol. 3, p. 332. [n.n.]
1934. *Omalaxis lamellifera,* Johnson, Proc. Boston Soc. Nat. Hist., vol. 40, p. 101. [n.n.]

Shell small, discoidal, flattened on the upper surface, broadly umbilicate below, the early whorls slightly exserted above the surface of the last whorl. Color greyish white, the periostracum yellowish brown. Nuclear whorls smoothish, inverted (the nucleus has been broken off since these characters were noted). Postnuclear whorls, of which there are about three, have very faint axial riblets, which gradually increase in strength, as does the subsutural cord, which appears in the early whorls. The last whorl is almost quadrangular, the right angles which bound the peripherical surface marked by cordlike carinae; the upper surface somewhat depressed at the suture, the lower surface rounded at the edge of the umbilicus. The whole surface is sculptured with prominent, rather closely set, retractively curved ribs; they are more prominent, almost nodulose, where they cross the carinae, and they are symmetrically arcuate on the peripherical surface, between the carinae; near the mouth the ribs are more closely and irregularly set, their prominence being largely due to the folding of the periostracum. The mouth has been broken away, but the broken aperture is rounded, while the carinae give the outer edge an angular appearance.

The unique holotype (U.S.N.M. no. 426235) was dredged in the Florida Straits in 205 fathoms, and measures 3 mm. in width and 1 mm. in height.

This species was first placed by Dall under *Omalaxis* Deshayes. This genus, however, whose type is *O. bifrons* Desh., is quite a different group, restricted to the Eocene, and having an orthostrophic nucleus. Three years later Dall transferred this species to *Discohelix* Dunker, a Mesozoic genus, also with an orthos-

trophic nucleus, according to Cossmann. Dall, however, made a new subgenus, *Discosolis,* for the recent American forms, *Omalaxis nobilis* Verrill and *lamellifera* Dall.

Fischer, in erecting the subgenus *Pseudomalaxis* for *Bifrontia zanclaea* Phil., confused under this species two forms, the original *B. zanclaea* from the Tertiary of Sicily, and a living form, with detached whorls, from the Mediterranean and Madeira, which possesses a Torinioid operculum. Monterosato (Proc. Malac. Soc. London, vol. 10, 1913, p. 362) correctly restricted *Pseudomalaxis* to the fossil form, raising it to generic rank, and describing a recent species from the Mediterranean, *P. actoni,* which closely resembles the fossil type species, and is even more closely related to *P. nobilis* Verrill from our coast. *Discosolis,* therefore, becomes a synonym of *Pseudomalaxis.*

Pseudomalaxis lamellifera, although related to *P. nobilis,* differs in several important respects, and needs to be placed in a new subgenus, which may be called Paurodiscus, differing from *Pseudomalaxis* s. s. in the following respects: shell much smaller; axial sculpture much stronger, and no spiral sculpture (as in nobilis); umbilical carina absent.

Dall placed in *Discosolis* also a species from the Caloosahatchie Pliocene, *D. retifera* (Trans. Wagner Free Inst., vol. 3, 1892, p. 332, pl. 19, figs. 1, 1b, 1c), which differs in having strong spiral striae nodulating the axial ribs, and in possessing a very strong umbilical carina, which is heavily denticulated. This may form the type of a genus which I shall call *Calodisculus,* and which I place near *Architectonica;* in the general nature of the sculpture, and in the form of the umbilical keel, it seems closer to this genus than to *Pseudomalaxis.*

Sayella livida, new species. Plate 7, fig. 7.

1893. *Sayella livida* Dall, Singley, Fourth Ann. Rep. Geol. Survey Texas, p. 343. [n.n.]
1934. *Sayella livida,* Johnson, Proc. Boston Soc. Nat. Hist., vol. 40, p. 159. [n.n.]

Shell small, elongate-ovate, straw-yellow, with a rather wide, subsutural, white band. Nuclear whorls about 1¼, inverted, colorless, glassy, smooth. The remaining 6½ whorls moderately convex, smooth except for fine growth lines, and crowded microscopic spiral sculpture; whorls closely appressed at the suture,

which is rather fine; last whorl half the length of the shell, its suture considerably below the periphery of the preceding whorl, giving the shell a constricted appearance in the middle. Aperture rather small, obliquely ovate; lip thin, thickening anteriorly, and passing into the base of the columella which is twisted into a strong fold; this part of the peristome is of a red-brown color, as is the area immediately surrounding the base of the columella.

The holotype (U.S.N.M. no. 125556), which was collected at Corpus Christi Bay, Texas, by J. A. Singley, measures 3.6 mm. in height, and 1.6 in width. A paratype from the same lot measures: height 4 mm., width 1.7 mm.

This is very close to *Sayella hemphilli* Dall, from Cedar Keys, Florida, but is less inflated, and has a constricted appearance in the penultimate whorl, mentioned in the description above. The examination of more material, however, from the region between the localities of the two species, may show that the two forms are actually one.

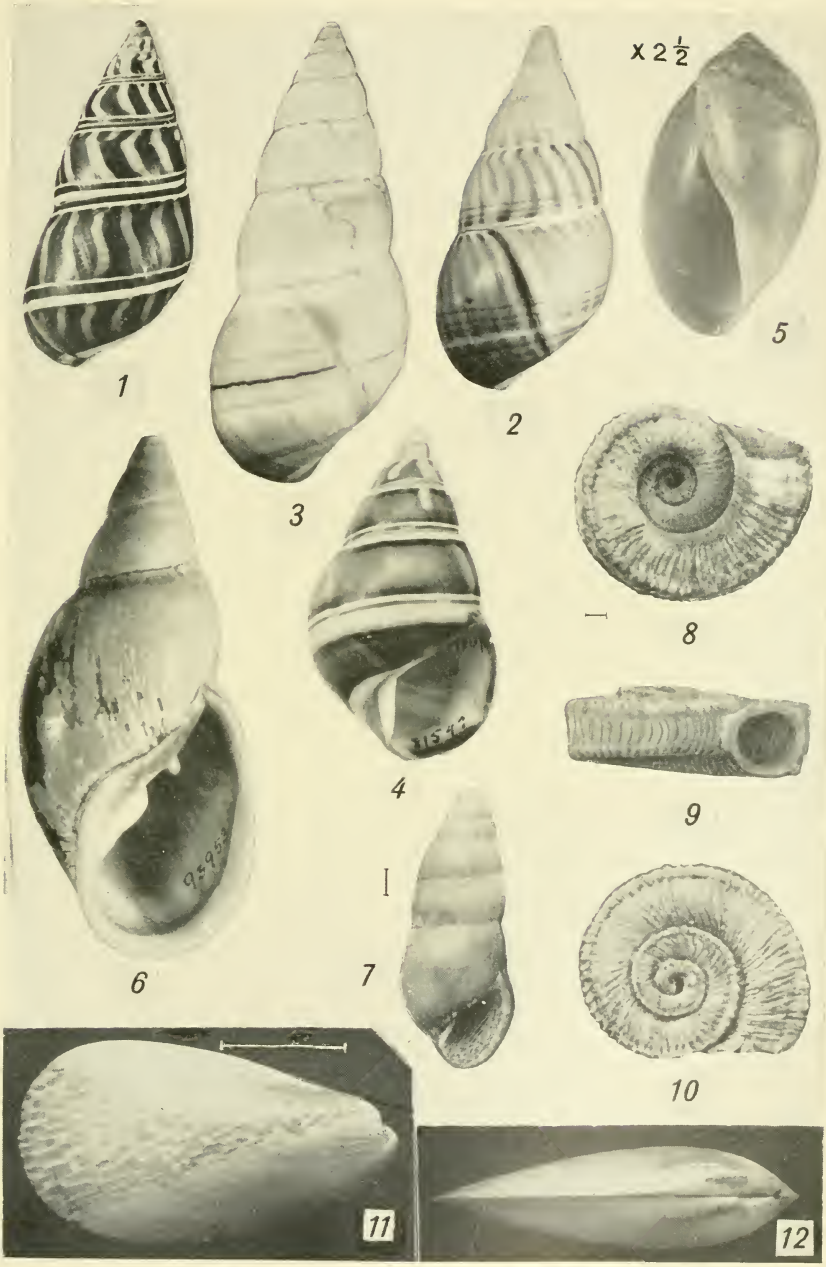
Dall placed *Sayella* in the Ellobiidae, but it seems that they really belong in the Pyramidellidae, and near the group that has been called *Syrnola,* containing *S. fusca* C. B. Adams, *producta* C. B. Adams, and related species. Bartsch referred these species to *Syrnola* with some doubt, and it seems probable that they should be removed from this genus, which has as a type a Japanese species of quite different appearance. It is possible that these species will find a place in the genus *Sayella;* a problem, however, that for the present I will not attempt to solve.

WEST AMERICAN SPECIES OF GONIOBASIS, WITH DESCRIPTIONS OF NEW FORMS

JUNIUS HENDERSON

Goniobasis orickensis, new species. Plate 4, fig. 10.

Shell solid, much resembling an elongate, slender *G. circumlineata* Tryon; surface dull, growth lines coarse; young specimens and upper whorls of adults dark reddish brown, due to coalescence of two or more dark color bands, often with a lighter band just below the suture; lower whorls horn colored, light brown or with a slight greenish cast, bands obsolete except a dark



1, Liguus blainianus pilsbryi Cl. 2, L. flammellus russeli Cl. 3, L. fasciatus mariae Cl. 4, L. fasciatus deckerti Cl. 5, Physa gouldi Cl. 6, Placostylus acutus Cl. 7, Sayella livida Rhdr. 8–10, Pseudomalaxis lamellifera Rhdr. 11, 12, Modiolus sagittatus Rhdr.

red basal band persisting internally and showing as a large terminal spot within the aperture at base of columella on nearly all but the largest specimens; whorls probably 9 or 10 (no complete adults available), somewhat convex; suture well impressed; a very few young examples with apex nearly complete show several rude, irregular axial plicae, lacking in most specimens; many examples exhibit a few spiral striae, with flat bands between, much as in *circumlineata;* aperture white within, or marked with brownish-red bands, especially in the young; columella usually purple.

Holotype, from Redwood Creek, Orick, California, University of Colorado Museum, No. 17710-a, a slender example: Alt. 20 mm., with several whorls wanting, probably original length about 23 mm. or more; diam. 11.5 mm. Many topotypes, same collection. Figured specimens, same collection, No. 17703-a, from a creek 26 miles east of Arcata, California, by winding mountain road, almost certainly Redwood Creek: Alt. 24.5 mm., several apical whorls missing; diam., 10 and 9 mm. respectively. It is abundant at both localities. We found it also in Willow Creek, Trinity River drainage, next valley east of Redwood Creek, and in a small creek 7 miles north of Orick.

This species differs from *G. yrekensis* in the absence of regular plicae, in surface texture, and in the presence of the conspicuous red spot at the base of the columella. It differs from *G. circumlineata* in the red spot, color bands and its more slender form. It differs from *G. shastaensis* Lea, from the Umpqua River in its lack of more or less regular spiral threads and lack of numerous regular axial plicae on the upper whorls. It is larger, more robust than the form identified as *G. draytonii* Lea, from California, and in the color bands, red spot and rougher surface. It is confined to the drainage indicated herein, so far as I know.

Goniobasis coquillensis, new species. Plate 4, fig. 6.

Shell small, slender, graceful; color tan, with a broad, brown peripheral band; whorls 9 or 10, quite convex, suture deeply impressed; some examples with a few obscure axial plicae on the uppermost whorls, which are usually quite smooth; last 3 whorls closely wound with fine, rather regular, threadlike striae, sometimes a little stronger just below the suture, often somewhat decussated by fine growth lines; aperture roundly ovate, nearly

one-third the total length of shell, white within; outer lip scarcely sinuous.

Holotype, University of Colorado Museum, No. 21167-a, creek at Riverton, on Coquille River, Oregon: Alt. 16 mm.; diam. 5.5 mm.; length of aperture 5 mm.; width 4 mm. Figured paratypes, same collection and locality, No. 21168-b. Topotypes examined by me, possibly from same creek, labelled "creek W. of Riverton Mine, Riverton, Ore.," in the Hannibal collection at Stanford University. Other localities, Hannibal collection, Stanford: a small creek at Coquille; Five Mile Creek, Coos Bay; creek at Blacklock Point, Cape Blanco; Hubbard Creek, three-fourth mile south of Port Orford; head of west branch of South Slough, Coos Bay; and Five Mile Creek, south of Bandon; all in Oregon.

Typically this form seems to be confined to the Coquille River drainage, flowing into Coos Bay, and small streams flowing into the ocean southward to Port Orford. It is readily distinguished from *G. shastaensis* Lea from the Umpqua drainage and southward, by its much smaller size, more slender form, more convex whorls, deeper suture, and almost total absence of plicae and striae from the upper whorls. At Riverton, I obtained in the Coquille River a fine lot of about the same general appearance and characters, except that all but the last two whorls are regularly and rather strongly plicate, seeming possibly to connect *coquillensis* with *shastaensis* as a subspecies. Two of them are figured for comparison Plate 4, fig. 7. Many lots of *shastaensis* have much weaker plicae than the typical form, but differ from *coquillensis* in other respects, and are readily distinguished even in colonies within the range of *coquillensis* south of Bandon.

Goniobasis chacei, new species. Plate 4, figs. 8, 9.

Shell quite small, slender, rather smooth; surface dull or somewhat polished; color medium to dark brown, often with a broad, obscure, darker peripheral band, which shows more clearly within the aperture; whorls 7 or 8, less convex and much smoother than in *G. coquillensis* (which it resembles in size and shape) and suture less deeply impressed; apical whorls mostly with a few rude, irregular axial plicae; last 2 or 3 whorls with 3 or 4 fine striae just below the suture, and usually a few very much finer striae below them; growth lines scarcely discernable on some

specimens; aperture roundly or elongately ovate, about one- third the total length of shell, more or less discolored within.

Holotype, Univ. Colo. Museum, No. 18058-a, small tributary of Smith River, Adams Station, Del Norte Co., Calif.: Alt. 12 mm. (apex wanting, original alt. about 14 or 15 mm.); diam., 5.5 mm. Figured paratype, No. 18058-b, and topotypes, No. 18058, from same lot. There are specimens in the same collection, also from Mr. and Mrs. Chace, from Smith River at Hiouchi Bridge and from a small stream near the bridge; a small creek near Patrick Creek, Smith River Canyon; Craig's Creek, (a tributary of Smith River), and a branch of Craig's Creek; Bear Creek; Mill Creek, 4 miles east of Crescent City (not quite typical); all in Del Norte Co., Calif. In the Hannibal collection, Stanford University, there are specimens from a creek flowing into Lake Earle 4½ miles north of Crescent City, another creek flowing past Wakefield Corners 2½ miles north of Crescent City, and a creek half a mile north of Lake Earle School, Calif.

This local form is typically confined to Del Norte County, so far as I know. It is smaller than the form identified as *draytonii,* differs in the presence of axial plicae on the upper whorls and spiral striae. Specimens from north of Wedderburn (Chace), and from first large creek north of Pistol River, a spring a mile south of Pistol River, a small creek between Chetco River and Harbor, Belling Creek at Illahe on Rogue River, and a small creek 10½ miles north of Weddenburn, (all in H. Hannibal collection, Stanford University), all in southwestern Oregon; seem closely related, but differ slightly in sculpture and are olive or greenish in color, a few showing two narrow bands on the last whorl and within the aperture. The same is true of a few from Roach Creek, northern Humboldt County, Calif., collected by Dr. W. G. Cooper (Stanford University collection). A lot from Patrick Creek, a mile and a half above Smith River, is typical in color, but almost devoid of spiral triae. These are all very puzzling and their relationship to other forms not at all clear.

G. coquillensis, though similar to *chacei* in size and form, is readily distinguished by its strong, rather regular, spiral striae. I at first supposed *chacei* to be *draytonii,* but it is certainly not the same as the material identified under that name from else-

where in northern California. Some lots strongly suggest affinity with the narrow forms of *nigrina.*

Goniobasis acutifilosa pittensis, new subspecies. Plate 4, fig. 11.

Shell rather small, solid; reddish brown, a little lighter just below the suture; surface dull and rough; spire tapering rather rapidly; whorls probably about 8, somewhat convex; growth lines coarse and irregular; spiral raised lines variable, often wanting or obscure. A few of the 21 specimens examined show one sharp, slightly interrupted spiral rib, or two, on the whorls, much like those of *G. acutifilosa* Stearns, with the same sort of flattened, non-sculptured zone between the upper spiral of the last whorl and the suture. It seems to be clearly related to *acutifilosa,* the shell being the same shape, but the spirals are even less developed than in *G. a. siskiyouensis* Pilsbry, from the headquarters of Fall River. The apical whorls are missing from all specimens.

Type and only known locality, Fall River Mills, at mouth of Fall River, on Pitt River, California, collected by Ellsworth Bethel. Associated with it were two nearly typical specimens of *acutifilosa.* Holotype University of Colorado Museum, No. 12080-a: Alt. 17 mm., original altitude probably about 22 mm.; diam. 9 mm. Figured paratypes, same collection, No. 12080-b.

PLATE 4

Fig. 1. *Goniobasis hemphilli,* n. sp. Near Portland, Oregon. Left, holotype. Right, paratype.

Fig. 2. *Goniobasis hemphilli dallesensis,* n. subsp. The Dalles, Oregon. Paratypes.

Figs. 3, 4. *Goniobasis yrekensis,* n. sp. Shasta River, California. 3, holotype. 4, paratypes.

Fig. 5. *Goniobasis yrekensis.* Klamath River, 4 miles east of Klamath, California.

Fig. 6. *Goniobasis coquillensis,* n. sp. Near Riverton, Oregon. Left, holotype. Right, paratype.

Fig. 7. *Goniobasis shastaensis* Lea, var. Riverton, Oregon. (For comparison).

Fig. 8. *Goniobasis chacei,* n. sp. Smith River, Adams, Oregon. Left, holotype. Right, paratype.

Fig. 9. *Goniobasis chacei.* Rogue River, Illahe Oregon.

Fig. 10. *Goniobasis orickensis* n. sp. Orick, California. Middle, holotype. Right and left, paratypes.

Fig. 11. *Goniobasis acutifilosa pittensis,* n. subsp. Mouth of Fall River, Fall River Mills, California. Left, holotype. Middle and right, paratypes.

JAMAICAN LAND SNAILS, 4

BY H. BURRINGTON BAKER

(Plates 8, 9)

The first paper of this series appeared in the first number of vol. 48; the symbols used for localities are explained on pages 7 to 9. In the following key to the Jamaican groups of Sagdinae, defining new subgenera, the abbreviated labels of pl. 8, fig. 1 are used.

A., appendix of penis (convoluted inside connective tissue sheath so that tip is attached to side of PA); C, carrefour; D, vas deferens; E, epiphallus (demarcated from PE by simple constriction; develops capsules of spermatophore); F, flagellum (structure as in *Hojeda* but more complex; develops fringed tail of spermatophore); FA, accessory flagellum; G, albumen gland; H, hermaphroditic duct; M, prostate; O, ovotestis; P, trunk of penis; PA, appendicular branch of penis (tip of evaginated organ in most species; with thickened rim around entrance of A.); PE, epiphallar branch of penis (usually not evaginated; apparently develops apical spine of spermatophore); PR, penial retractor (origin from diafram); S, spermathecal sac; SD, spermathecal duct (slender part); SR, spermathecal retractors (origins from ring around base of albumen gland); SS, secondary spermatheca (enlarged stalk; contains spermatophore in one species); T, atrium; U, oviduct (uterus + free oviduct); V, vagina.

A(B) g. *Volvidens,* type *V. tichostoma* (Pfr.); anatomy unknown; shell with parietal lamella. Also with palatal and basal teeth; type *V. triodon* n. sp. sg. **Trifaux** new.

B(A) g. *Hyalosagda;* anatomy fundamentally like that of *Proserpinula;* shell without parietal lamella. (I) smaller species (excl. s.s.); apparently oviparous; pr inserted on side of e; f more flattened (with 1 or 2 series of caeca); jaw plaited. (H) mantle collar not broadly expanded; shell perforate to umbilicate (excl. *osculans* and *simplex*). (F) sg. *Lacteoluna;* f shorter than p+pe+e; most radular marginals with pointed entocones. (E) pr inserted considerably below entrance of d. (D) later shell whorls with irregular, coarse growth-wrinkles that collect dirt. (C) protoconch with sharp spirals on last whorls; type *H. selenina* (Gld.) st. *Lacteoluna* Pils.

C(B) protoconch with irregular pits and obsolescent spirals; type *H. subpyramidalis* (C.B.A.), incl. (animal unknown) *H.* (*Vilitas*) *omissa* (Pils.) st. *Aerotrochus* Pils.

D(B) later shell whorls with clean rib-striae like *Strialuna* but more arcuate; protoconch smoothish with growth-lines most prominent sculpture; type *H. epistyliulum* (C.B.A.)
st. **Microsagda** new.

E(B) protoconch with forwardly and backwardly oblique threads separated by similarly arranged pits; later whorls with very fine, sharp, close rib-striae (type also with distant riblets); pr near d; type *H. diminuta* (C.B.A.) st. *Strialuna* Pils.

F(B) f longer than p+pe+e. (G) mantle with some black pigment; protoconch smoothish with traces of x-lines and slightly stronger spirals; later whorls with sharp criss-cross diagonal threads; outer radular marginals with pointed entocones; jaw thin; type *H. anthoniana* (C.B.A.)
sg. **Stauroglypta** new.

G(F) mantle jet black, visible through almost smooth, transparent shell; marginals rarely with entocones; jaw with central plaits thickened; type *H. similis* (C.B.A.)
sg. *Hyalosagda* Albers.

H(B) g. *Proserpinula* Albers, type *P. discoidea* (C.B.A.); mantle collar broadly expanded, capable of covering part of shell; radular marginals with largest cone spatulate and apically bifid (pl. 8 f. 2); shell imperforate, very smooth with thin epidermis.

I(B) g. *Sagda;* larger species or without transparent shell; ovoviviparous (all?); pr inserted at base of e; f long and more rounded; jaw striate; radular marginals rarely with entocones; shell imperforate. (K) secretive species with whitish to grayish, thinner integument; sd attached to tip of ss and paralleled by sr to base of g; fa not much longer than width of e; a. not excessively long; t short; shell with narrow whorls and with basal and columnar lamellae usually present. (J) pa longer than pe; shell with less swollen last whorl and less convex base; type *S. jayana* (C.B.A.) st. *Parahelix* v. Iher.

J(I) pa shorter than pe; shell with swollen last whorl and convex base; x-striae usually evident; type = *S. cookiana* (Gm.)
st. *Sagda* Beck.

K(I) g. *Zaphysema;* usually active species with thick, colored (olive to reddish) integument; sd attached below tip of ss which extends to base of g; t about as long as pe; shell brownish, hirsute at some stage. (L) fa as long as e; pa longer than pe but a. not excessively long; shell quite closely coiled, often with peripheral internal lamina; type *Z. lamelliferum* (C.B.A.)
sg. **Meiophysema** new.

L(K) fa often large; pa shorter than pe and a. several times as long as animal; shell with rapid whorl increase and without laminae; type *Z. tenerrimum* (C.B.A.) sg. *Zaphysema* Pils.

Volvidens (Trifaux) triodon new species. Plate 8, figs. 9 to 11.

Shell minute, umbilicate, with low domed spire and high narrow whorls; whitish corneous but collecting dirt. Embryonic whorls $2\frac{1}{8}$; apical $\frac{3}{4}$ ($1\frac{1}{4}$ sutural count) very rapidly increasing to form a small cap which is partly hidden by next whorl and limited by a sulcus; remainder with spiral rows of extremely fine points. Later whorls shouldered above and below with (at least on last) a sulcus midway between; with irregularly spaced major threads (32 on last) and extremely fine, very irregular, very closely spaced, minor wrinkles which are often beaded although continuous spirals are lacking; accumulating dirt so as to give at least the appearance of deciduous growth riblets. Umbilicus 3.9 times in maj. diam. Aperture trefoil; peristome sharp and almost vertical, with just behind it a palatal nodule opposite the sulcus and a basocolumellar one; parietal wall (penult wh.) with a low rounded lamella which is present as deep as visible and emerges $\frac{1}{12}$ whorl. Alt. of type (figs.) 1.75 mm., maj. diam. 150 (2.63 mm.), min. diam. 141 (2.46 mm.), alt. apert. 52 (.91 mm.), diam. apert. 110 (1.00 mm.), with $5\frac{1}{4}$ whorls. Type locality (ANSP. 163915): WWF.

Hyalosagda (Strialuna) haplotrema new species. Plate 8, figs. 4 to 6.

Shell with $1\frac{1}{2}$ embryonic whorls about half again as large as in *H. sincera,* and very sharply but similarly sculptured. Later whorls more evenly rounded, with subequal, extremely fine, sharp, close rib-striae and without tendency towards major riblets that especially characterize var. diminuta. Umbilicus relatively larger (3.2 times in maj. diam.). Peristome sharp almost vertical, little arcuate. Alt. of type (figs.) 1.99 mm., diam. 191 (3.81 mm.), min. diam. 178 (3.55 mm.), alt. apert. 69 (1.38 mm.), diam. apert. 104 (1.44 mm.), with $4\frac{1}{4}$ whorls.

Type locality (ANSP. 163916): MN3c. *H. haplotrema* superficially resembles *H. inconspicua* (C.B.A.) but the latter has whorls shouldered above and below, a relatively smaller umbilicus and much more arcuate rib-striae and peristome.

Sagda kingswoodi new species. Plate 9, figs. 6 and 7.

Shell small and thin, straw-colored. Spire convex, noticeably lower than height of last whorl; first $1\frac{1}{2}$ whorls almost smooth, remainder with weak growth-wrinkles becoming almost obsolete below periphery, crossed by microscopic, obliquely criss-cross striae (as usual in *Sagda* s.s.). Last whorl high, weakly suban-

gulate; base very convex, narrowly but deeply funicular. Basal lamina (fig. 6) thin but continuous, stopping about $\frac{1}{12}$ whorl inside of peristome and extending almost $\frac{3}{4}$ whorls; columellar lamella steeply inclined and quite high, stopping about $\frac{1}{8}$ whorl inside and extending $\frac{1}{2}$ whorl. Alt. of type (fig. 7) 11.5 mm., maj. diam. 118 (13.6) min. diam. 114 (13.1 mm.); almost 7 whorls. Dimensions of another: 11.2, 127 (14.5), 121 (13.8); $7\frac{1}{4}$ whorls.

Type locality (ANSP. 163918): WC2, along buttresses of a silk-cotton tree. *S. kingswoodi* has a much more impressed base than any other species of *Sagda* s.s. except *S. cookiana,* which is a much larger species with an interrupted basal lamina.

S. (Parahelix) connectans catadupae new subspecies. Plate 9, figs. 10, 11.

Shell smaller and usually more elevated, with more convex spire and with coarser growth-wrinkles. Lamellae (fig. 10) much as in typical *S. connectans.* Alt. of type (fig. 11) 13.1 mm., maj. diam. 128 (16.7 mm.), min. diam. 123 (16.1 mm.); $8\frac{1}{2}$ whorls. Dimensions of another: 11.8, 143 (16.9), 138 (16.3); almost 8 whorls.

Type locality (ANSP. 163919): VW2. In sculpture and form, this subspecies slightly approaches *S. epistylioides* (Fér.).

S. (P.) occidentalis new species. Plate 9, figs. 3 to 5.

Shell heavy, low (type) to medium (fig. 5) in height; base moderately concave. Growth sculpture above periphery of post-embryonic whorls about as coarse as in *S. maxima,* weaker on last whorl and obsolete below periphery; microscopic criss-cross striae obsolete. Internal lamellae (fig. 4) situated much as in *S. connectans* and *S. epistylioides* but shorter; basal lamina stopping $\frac{1}{8}$ whorl from peristome, high for $\frac{1}{2}$ whorl but visible for almost $\frac{1}{2}$ whorl more; columellar lamella about $\frac{3}{8}$ whorl in length and reaching to within $\frac{1}{4}$ whorl of peristome, heavy, low and with outer side almost vertical. Alt. of type (fig. 3) 18.8 mm., maj. diam. 139 (26.1 mm.), min. diam. 127 (23.9 mm.), with $7\frac{3}{4}$ whorls; dimensions of fig. 5: 19.7, 122 (24.1), 116 (22.8) with $8\frac{1}{4}$.

Type locality (ANSP. 163920): WWF. Although superficially similar to young shells of *S. maxima* in appearance, *S. occidentalis* is structurally almost intermediate between the *connectans-epistylioides* and the *jayana-adamsiana-montegoensis*

groups. It is nearest *S. epistylioides* but has considerably weaker and more irregular growth wrinkles.

S. (P.) spei portlandensis new subspecies. Plate 9, figs. 8 and 9.

Shell with more conoid apex and less convex outlines. Columellar lamella (fig. 8) low and rounded but more extensive, forming a weak but distinct swelling on the peristome. Alt. of type (fig. 9) 19.4 mm., maj. diam. 110 (21.3 mm.), min. diam. 104 (20.2 mm.), with 9¼ whorls.

Type locality (ANSP. 163921): EEJb. This subspecies approaches *S. torrefacta* (C.B.A.) in both of its points of difference from typical *S. spei.*

S. (P.) maxima jacobensis new subspecies. Plate 9, figs. 1 and 2.

Shell with finer and weaker growth wrinkles and thus appearing smoother than typical, coarsely sculptured *S. maxima.* Alt. of type (fig. 1) 28.4 mm., maj. diam. 110 (31.3 mm.) min. diam. 99 (28.1 mm.), with 8½ whorls.

Type locality (ANSP. 163922). VF. This subspecies somewhat approaches *S. alligans* (C.B.A.) in appearance but completely lacks lamellae (fig. 2).

Brachypodella (Geoscala) costulata savlamari new subspecies. Plate 8, fig. 3.

Shell with less pronounced suture and with more closely spaced ribs (18 on last adnate wh.; 10 on "neck"), which are weak or obsolete near middle of last 2 or 3 whorls; last half whorl deeply sulcate. Alt. of type (fig.) 6.61, diam. 2.52, diam. spire 2.11, alt. last wh. 2.87, alt. apert. 1.41, diam. apert. 1.58 mm., with 7¼ whorls remaining (+7½).

Type locality (ANSP. 163928): WC1. Except in size, this subspecies is intermediate between typical *B. costulata* and *B. robertsi.*

Cepolis (Dialeuca) conspersula negrilensis new subspecies.

Shell nearest *C. c. platystyla* (Pfr.) but smaller with more convex outlines; last whorl weakly subangulate. Color brownish corneous with dark brown subsutural band; last whorl with darker varices and irregular series of small chalky blotches. Alt. of type 14.1 mm., maj. diam. 124 (17.5 mm.), min. diam. 111 (15.7 mm.), alt. apert. 50 (7.1 mm.), diam. apert. 151 (10.7

mm.), $5\frac{1}{4}$ whorls. Type lot varying from 16.4×103 (16.9 mm.) with 6 wh. to 11.6×135 (15.5 mm.) with 5 whorls.

Type locality (ANSP. 163924): WWC.

BURROWING OF SNAILS

BY DAVID T. JONES
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While testing temperature reactions of the tiger snail, *Anguispira alternata* (Say), in December of 1932, it was noted that this snail followed a somewhat regular procedure in burrowing which was correlated with certain temperatures. Continuing these observations in December, 1934, I found Utah snails behaved somewhat similarly. The work on *A. alternata* was done in the Zoology Department of Indiana University, with snails secured the same day from the campus. At Utah, the snails had to be collected several weeks prior to the experiments, but they were kept in cool places under conditions as nearly normal as possible. The specimens of *Oreohelix depressa* (Cockerell) and *Discus anthonyi* (Pilsbry) came from City Creek Canyon near Salt Lake City, those of *Physa ampullacea* Gould and *Stagnicola nuttalliana* (Lea) came from the Weber River at Gateway, and those of *Gyraulus vermicularis* (Gould) from Oakley, Utah, farther up Weber Canyon.[1]

All tests were made out-of-doors using a liter Erlenmeyer flask, fitted with a two-holed rubber stopper, one hole communicating with the exterior, the other containing a two-inch immersion Centigrade thermometer. Loose soil was placed in the bottom of the flask in all cases. In the case of aquatic snails the sediment was allowed to settle before beginning the experiment. In the case of land snails, the soil and the sides of the flask were moistened to maintain 100% relative humidity. The barometric pressure was not controlled but was allowed to vary naturally with weather and altitude, as specimens of

[1] "Mollusks from Weber Canyon" by David T. Jones, Proc. Utah Acad. Sci., Arts, and Letters, forthcoming Vol. XII, 1935.

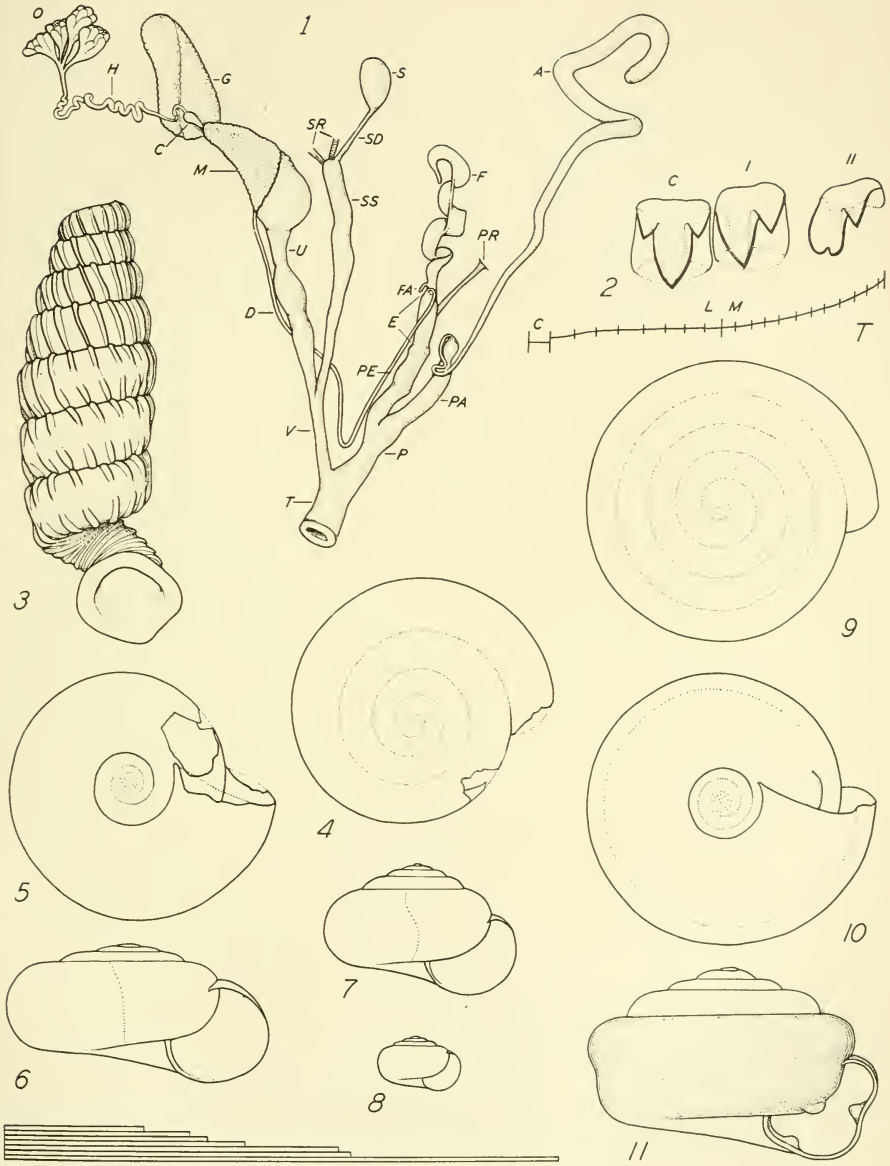

Plate 8. Uppermost scale is for figs. 7 and 8, second for fig. 2, third for fig. 2T, fourth for fig. 1, fifth for fig. 3, sixth for fig. 6 and lowest for fig. 11; second represents .05 mm., third .2 mm., and the others 5 mm.

1, 2. Proserpinula discoidea. 3. Brachypodella costulata savlamari. 4–6. Hyalosagda haplotrema. 7. H. spreta, EJ2. 8. H. angustispira, EEJ. 9–11. Volvidens triodon.

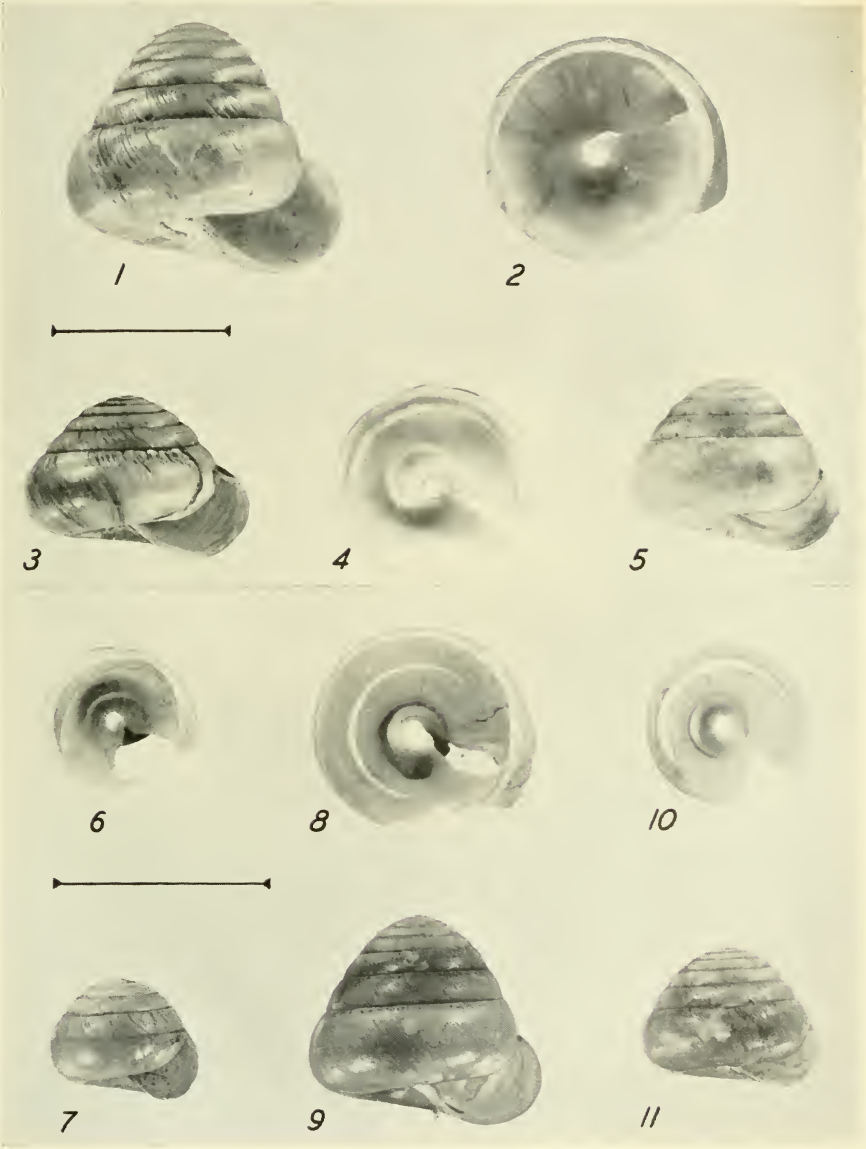

Plate 9. Upper scale is for figs. 1–5, lower for figs. 6–11; each represents 2 cm. Photographed by Alfred Zimmerman.

1, 2. Sagda maxima jacobensis. 3–5. S. occidentalis. 6, 7. S. kingswoodi. 8, 9. S. spei portlandensis. 10, 11. S. connectans catadupae.

depressa, shipped from Utah to Indiana in 1932, did not react well under changed environmental conditions. The behavior of the snails was checked while the temperature was dropping and again while it was rising. Activity was found to be practically identical in the two cases at the same temperature. Cooling extended usually over a period of about two hours in each test, and was aided in the lower stages by placing the flask in a salty ice mash when necessary. In the case of aquatic species, snow and ice were slowly added to the water.

The number of each species varied with the specimens available, as follows: *alternata,* five tests with 60 snails in all; *depressa,* five tests with 41 snails; *anthonyi,* three tests with six snails; *ampullacea,* three tests with seven snails; and *vermicularis,* four tests with 20 snails. Not all snails reacted each time. *D. anthonyi,* in particular, seemed very difficult to arouse from hibernation, though it reacted well when aroused. In each trial in the case of the land snails a few individuals would go back in the shell, seal the aperture with an epiphragm, and make no attempt to burrow.

The land snails examined showed two quite definite periods of activity, the high period being somewhere near or just below room temperature, the low period being close to or just above the freezing point. As near as I could determine the high period of activity was as follows: for alternata, 13 to 10 degrees C.; for *depressa,* 19 to 11; for *anthonyi,* 24 to 16. Just below this temperature is a sluggish period, followed by the low period of activity which is as follows: for *alternata,* 4 to 1 degree C.; for *depressa,* 8 to 3; for *anthonyi* 11 to 4. Below this lower limit there is still sluggish activity. Probably burrowing continues underground for some degrees below zero Centigrade.

Discus anthonyi has not been observed to burrow yet, though, no doubt, it does. Probably as often, however, it will seal itself to a leaf or twig, and remain dormant, after having formed the usual epiphragms. *Oreohelix depressa* starts burrowing by lifting adhering particles of dirt with the sole of its foot. As these are moved aside the shell is usually turned edgewise and wedged in the excavation. The process is then repeated at the side of the shell, until the shell is covered. *A. alternata* goes down

in much the same way, but has the peculiar habit of clustering at about 4 degrees C. These snail clusters, composed of varying numbers of individuals, then go downward as a ball of shells and writhing snails. While it is very difficult to observe what is happening to individuals in such an aggregation, it seems that the large snails do most of the excavating, and the small ones follow afterward down the same hole. One should consider though that relatively the larger ones would apparently do the more work, and would appear to go down faster anyway. In *A. alternata* all active snails are usually buried at zero C., but in *O. depressa* complete covering of active individuals is usually at a lower temperature.

Of the aquatic snails examined the periods of activity are not nearly so evident as in the land snails. In the case of *Stagnicola* and *Physa* the problem is complicated by their coming for air, even at temperatures near zero C. As the cold increases they tend to stay near the bottom, but may be sluggishly active even with ice over the top of the vessel. The silt on the bottom, loosened by the water, makes burrowing relatively easy and mechanically simple, especially in a current where it is washed over the snails. It is doubtful if aquatic snails burrow deeply unless forced to do so by the water above freezing solid.

NOTES AND NEWS

Cuttle Bone for Cultures of *Helix nemoralis*.—In cultures of *Helix nemoralis* maintained at the Biological Institute of Harvard University, the snails frequently attacked one another for the lime in the shells, the first two or three whorls of the shell being removed. The losses due to such activity were greatly reduced by the addition of a cuttle bone to each culture. The snails had no difficulty with the soft material and it provided a good source of lime. —R. A. McLean.

African Slugs.—Collinge in 1910 proposed a new family Aperaidae for the genus *Apera* Heynemann, which is identical with the earlier *Chlamydephorus* W. G. Binney. It was claimed that the name proposed by Binney was preoccupied, having been

used for a genus of mammals. But the mammalian genus was *Chlamyphorus* Harlan, 1825, and the name proposed by Binney stands. The family appears to be well founded, and should be called Chlamydephoridae. (Not Chlamydophoridae Gray, 1869, which should have been written Chlamyphoridae).

Oopelta Mörch appears to be correctly placed in a subfamily Oopeltinae of Arionidae. The group must be considered endemic in South Africa.

O. nigropunctata Mörch was supposed to come from Guinea, but Collinge received it from S. Africa and his identification seems to be perfectly valid. Collinge also saw specimens of *O. aterrima* (Gray), labelled *O. nigropunctata,* and said to be from Guinea, but doubtless the locality was added to agree with the species as identified.

Milax appears to be doubtfully native of South Africa though it is apparently so in Morocco and Algeria. P. Hesse (1926) divides the Parmacellinae into two groups, one containing *Parmacella* and *Boettgerilla,* the other *Milax* and *Aspidoporus.* It would seem better to treat the second division as a separate subfamily, Milacinae. —T. D. A. Cockerell.

Lioplax subcarinata occidentalis, new subspecies.—The shell is larger, more acutely conic than *L. subcarinata,* the summit perfect or nearly so, and the spiral striation weaker; the umbilicus is often larger. Length 20 mm., diam. 14 mm.; 5 whorls (+ one lost). Cincinnati, Ohio, type 123539 ANSP. This form was figured by W. G. Binney, Land and Freshwater Shells of N. A., part 3, figs. 119, 120, as *L. subcarinata,* which is a species of the Atlantic drainage, type locality Delaware River. Dr. James Lewis was the first to suggest the propriety of separating the western race from the eastern. *Paludina sulculosa* Menke, 1828, was said to be from Cincinnati collected by Beschke, but the description agrees fully with the Philadelphian, and not with the western form, in exactly those characters wherein the two chiefly differ, that is, the eroded apex and the decussate sculpture. Since Beschke sent shells from both Philadelphia and Cincinnati to Menke, it seems likely that a mistake was made in the locality. The dimensions given for *sulculosa*

agree with young males from the Delaware River. *L. s. occidentalis* is a common snail in Indiana, Illinois and Iowa.—*Pilsbry.*

Chondropoma gnote, new name for *C. soror* Pils., 1933, Proc. A.N.S. Phila. vol. 85, p. 124, not *C. soror* Pils., 1930, P.A.N.S. Phila. vol. 82, p. 299. Dr. Bartsch has kindly called my attention to this duplication of names.—*Pilsbry.*

Mr. W. F. Webb is spending the winter at St. Petersburg, Florida, where he will be glad to see shell collectors at 2210 12th St.

The Fifth Annual Meeting of the American Malacological Union.—The fifth annual meeting of the American Malacological Union will be held in the Buffalo Museum of Science, Humboldt Park, Buffalo, New York, Thursday to Saturday, June 27 to 29, 1935.

In addition to the usual business sessions and reading of papers, the tentative program provides for a lecture at the Museum on Thursday evening, the annual dinner at Hotel Statler Friday evening, and two field trips on Saturday. East Aurora, made famous by Elbert Hubbard as the Home of the Roycrofters, fine art craftsmen, will be visited Saturday morning, with luncheon at the Roycroft Inn. Here Cazenovia Creek will be explored with its abundant molluscan fauna including *Radix auricularia.* In the afternoon Niagara Falls will be the objective where mollusks live on the spray-washed rocks as well as in the river itself. The meeting will be officially disbanded here.

Hotels:—Statler, Delaware Avenue at Niagara Square; single room with shower, $3.00; double, $5.00, $5.50; single, with shower and tub, $3.00; double, $5.00; twin beds, $6.00. Lenox, 140 North Street, single without bath, $1.50; double, $2.50; single with bath, $2.00, $2.50; double, $3.50. Lafayette, Washington and Clinton Streets, (down town), single with bath, $2.50, $3.00, $3.50; double, $4.00, $5.00, $6.00.

Annual dinner at Hotel Statler, $1.50. Please send titles of papers and time required to Mrs. Harold R. Robertson, Buffalo Museum of Science, Humboldt Park, Buffalo, New York.

Vol. XLVIII JULY, 1934 No. 1

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BY CHARLES W. JOHNSON

Proceedings of the Boston Society of Natural History vol. 40, no. 1, p, 1–204. Issued July 31, 1934. Price, $1.25.

For the first time a list of all the known forms of marine mollusks found on the Atlantic coast has been compiled. The major groups are listed; the genera and species are given, with author and date of their description, and in the case of many forms a brief statement of range, including depth, is made. The paper contains an index and an excellent bibliography.

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